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N.A.A. BULLETIN

April 1961

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N.A.A. BULLETIN

Vol. XLII No. 8 APRIL, 1961

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This *Bulletin* is published monthly by the National Association of Accountants, 505 Park Ave., New York 22, N. Y. Subscription price $10 a year, for members only. Second class postage paid at New York, N. Y.

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The Mathematics of Accelerated Depreciation

by PAUL H. VAN NESS

THIS ARTICLE consists of a restatement, in algebraic terms, of the operations of declining-balance and sum-of-the-years'-digits depreciation. It will be demonstrated that the essential elements of these techniques can be summed up in six equations:

Declining Balance

1. Net balance at the end of any year: $B_E = AC^E$
2. Depreciation accrued to the end of any year: $D_E = A(1-C^E)$
3. Depreciation taken in any year: $D_x = rAC^{E-1}$

Sum-of-the-Years' Digits

1. Net balance at the end of any year:

$$B_E = A\left(1 - E\left(\frac{2N-(E-1)}{N(N+1)}\right)\right)$$

2. Depreciation accrued to the end of any year:

$$D = AE\left(\frac{2N-(E-1)}{N(N+1)}\right)$$

3. Depreciation taken in any year:

$$D_x = A\left(\frac{2(N-(x-1))}{N(N+1)}\right)$$

The declining-balance equation can be readily solved on a desk calculator. The sum-of-the-years'-digits equations look more complicated, but a few experiments will convince the reader that they too can be worked on a desk calculator or even on an adding machine. In a pinch, quick answers to *SYD* problems can be obtained by using only pencil and paper. It is, therefore, felt that there can be practical day-to-day application of the above formulas. It is further suggested that such formulas might find useful application in computer programs dealing with fixed asset depreciation and serve as useful tools in appraising the accuracy of book depreciation without having to trace through the individual depreciation calculations.

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Declining-Balance Depreciation

An understanding of the equations requires that their derivation be explained in detail. Accounting and mathematical theories are both indispensable to the formulas, as each reacts upon the other. We begin by assigning symbols to the various elements in the computation, thus:

- A — Price of the asset.
- B — Net balance at the end of any year.
- C — Complement of depreciation rate.
- D — Depreciation accumulated in any number of elapsed years.
- D_x — Depreciation taken in any particular year.
- E — Elapsed number of years.
- N — Service life in years.
- r — Depreciation rate.
- x — Any particular year during the service life.

It is a wise safeguard, in an investigation of the algebraic properties of an accounting technique, to draw up an arithmetic example. Exhibit 1 consists of the depreciation schedule of a $1,000 asset with a five year service life under the double-declining balance method.

Several characteristics of the method stand out. The rate remains constant but is applied to a decreasing balance, and the amount of depreciation taken declines sharply from year to year. The rate of .40 represents a service life estimate of five years ($2 \times \frac{1}{5}$). In terms of the symbols assigned, $r = 2(1/N)$. Unlike straight-line depreciation, this procedure fails to amortize the full price

The Arithmetic of Double Declining Balance Depreciation

Period	Beginning balance	Rate	Annual depreciation	Accumulated depreciation	Ending balance
1	$1,000	.40	$400	$400	$600
2	600	.40	240	640	360
3	360	.40	144	784	216
4	216	.40	86	870	130
5	130	.40	52	922	78

EXHIBIT 1

of the asset during the service life. Accountants have called the residue "salvage value." We shall have something to say about this later on.

Clearly, the depreciation taken in the first year is represented algebraically by the product rA. The balance at the end of the first year equals $A - rA$ (price less depreciation taken). Depreciation taken in the second year may be described verbally as the product of the net undepreciated beginning balance and the rate. In terms of the symbols used here, $D_2 = r(A - rA)$. The net balance at the end of the second year is certainly the price of the asset less depreciation taken in the first and second years. This may be expressed as:

(1) $B_2 = A - rA - r(A - rA)$

Removing the parentheses and combining terms yields:

(2) $B_2 = A + r^2 A - 2rA$

The A may be factored:

(3) $B_2 = A(r^2 - 2r + 1)$

The parenthetical expression is the square of $(r - 1)$.

(4) $B_2 = A(r - 1)^2$

Equation (4) suggests a general statement:

(5) $B_E = A(r - 1)^E$

The term $(r - 1)^E$ is evaluated for any elapsed number of years, E, by means of the binomial expansion. A general statement of the expansion can be found in any mathematics reference under a discussion of the binomial theorem. Expressed in terms of the symbols employed here, the binomial theorem is:

$$(6)\quad (r-1)^E = r^E + Er^{E-1}(-1) + \frac{E(E-1)}{2!}r^{E-2}(-1)^2 + \frac{E(E-1)(E-2)}{3!}r^{E-3}(-1)^3 + \ldots + r^{(E-E=0)}$$

The exclamation point indicates the product of all integers up to and including the one specified. Thus, $3! = 3x2x1 = 6$. It is read, "three factorial." The final term is inserted to show that the series ends when the exponent of r is zero.

Finding that the binomial expansion is involved in declining-balance depreciation is an unexpected dividend of the algebraic approach. The explanation is suggested in the derivation. Examination of equation (1) indicates that the number of r terms in the extended form is related to the number of elapsed years, and that when combined, as in equation (2), they will always form a power of $(r - 1)$ equal to the number of elapsed years.

As a test of equation (5), the reader is invited to deduce the expression for the net asset balance at the end of the fourth year by writing out all the r's

and A's required and combining terms. The procedure is outlined in steps (1) through (3). The expression will prove to be identical with the binomial expansion of:

$$B_4 = A\,(r-1)^4 \qquad B_4 = A\,(r^4 - 4r^3 + 6r^2 - 4r + 1)$$

Now, $(r-1)$ refers to the complement of r, that is . . . that number which when added to r, produces unity. We have assigned the symbol C to the complement of r, and we achieve an elegant equation for the undepreciated portion of the price of the asset at the end of any period.

(7) $B_n = AC^E$

When r equals .4, as in the arithmetic table, we should expect the net ending balances to consist of powers of six $(.4 + .6 = 1)$ as adjusted for the decimal point and the value of A.

Example: The undepreciated amount of an asset with an original price of $1,000 at the end of four years with an estimated useful life of five years is:

$B_n = AC^E$

$B_4 = 1000 \times .6^4$

$B_4 = \$130$

Refer to Exhibit 1 for test of accuracy.

It must be understood that the value of E can never exceed the service life estimate. That is, $E \leqq N$. This limitation is imposed not by mathematics but by the accounting theory underlying declining-balance depreciation. The price of the asset is transferred to cost via depreciation only during its service life. At the end of that time, depreciation stops even though the asset may continue in use, and even though the price has not been entirely expensed. Two related reasons for this peculiarity can be discerned in the case of declining-balance depreciation. The first is an accounting matter. Like all depreciation methods, this one requires a stated time period in its computations. Accounting theory specifies that depreciation expense ceases at the expiration of the service life. The second is purely mathematical. The term C^E can never equal zero, and therefore the ending balance, B_E, can never equal zero.

We may now question the claim that the residue under this method is "salvage value." We know (from equation 7) that the ending balance is an exponential function of the complement of the rate. We take judicial notice of the factors bearing on salvage value — technology, age, price levels, maintenance, etc. And we ask, is it plausible to assume that the effects of all these forces are summed up in the symbol E? The symbol E, after all, stands merely for the number of elapsed years of the service life.

If the net ending balance can be expressed so simply, it is reasonable to hope that the amount of depreciation accrued to date through any year will also form a straightforward equation. At the risk of belaboring the obvious, such an equation will be derived here. Recall equation (7) for the net ending balance:

(7) $B_E = AC^E$

Depreciation accrued may always be obtained by subtracting the net balance from the price.

(8) $D_E = A - B_E \quad \therefore \quad D_E = A - AC^E$

The A may be factored.

(9) $D_E = A(1 - C^E)$

Equation (9) yields the amount of depreciation taken in E years.

Example: The cumulative depreciation through the third year of an asset with an original price of $1,000 and having an estimated useful life of five years is:

$D_E = A(1 - C^E)$ $\qquad$ $D_3 = 1000(1 - .216)$

$D_3 = 1000(1 - .6^3)$ $\qquad$ $D_3 = \$784$

Refer to Exhibit 1 for test of accuracy.

Can we find an equally elegant equation for the depreciation taken in any year? Let us begin our search by expressing the amount in terms of r and A. Depreciation taken in the first year is rA. In the second year it is the product of the rate and the beginning balance: $r(A - rA)$. Again, in the third year it is:

(10) $D_3 = r[A - rA - r(A - rA)]$

Removing parentheses:

(11) $D_3 = r(A - 2rA + r^2A)$

The A may be factored:

(12) $D_3 = rA(r^2 - 2r + 1)$

The parenthetical expression is the square of $(r - 1)$:

(13) $D_3 = rA(r - 1)^2$

We note that $(r - 1)$ is the complement of r, and that its exponent is one less than the number of the year in question. The equation we are looking for is:

(14) $D_x = rAC^{x-1}$

In order to maintain the distinction between total number of years, E, and any particular year, x, different symbols have been employed. At this point it is necessary to risk confusion and point out that at the end of the third year, for example, three years have elapsed. In terms of the symbols, $x = E = 3$. Consequently, E may be substituted for x in (14):

(15) $D_x = rAC^{E-1}$

This equation shows that the depreciation taken in any year consists of the product of the rate and the price multiplied by the complement of the rate raised to a power of one less than the number of years elapsed. As usual, this equation can be compared to the arithmetic table.

Example: The depreciation in the fourth year of an asset with an original price of $1,000 having an estimated useful life of five years is:

$$D_x = rAC^{x-1} \qquad D_4 = 400 \times .6^3$$
$$D_4 = .4 \times 1000 \times .6^{(4-1)} \qquad D_4 = \$86.$$

Declining-balance depreciation appears to be a mathematical marvel. Simple algebraic expressions exist for all elements of the procedure — the net ending balance, depreciation to date, and depreciation in any particular year. They are all exponential equations based upon the complement of the rate.

Sum-of-the-Years'-Digits Depreciation

Since declining-balance depreciation submitted so gracefully to mathematical analysis, sum-of-the-years'-digits depreciation might also conceal interesting algebraic relationships. Before considering the symbols to be employed, we will

The Arithmetic of SYD Depreciation

Period	Price	Rate	Annual Depreciation	Accumulated Depreciation	Net Balance
1	$1,000	$\frac{5}{5+4+3+2+1}$	$333	$ 333	$667
2	1,000	$\frac{4}{5+4+3+2+1}$	267	600	400
3	1,000	$\frac{3}{5+4+3+2+1}$	200	800	200
4	1,000	$\frac{2}{5+4+3+2+1}$	133	933	67
5	1,000	$\frac{1}{5+4+3+2+1}$	67	1,000	-0-

Note: The above table and all future examples assume a residual value of zero.

EXHIBIT 2

construct an arithmetic table (Exhibit 2). This method contrasts sharply with declining-balance depreciation. Here the rate changes but is applied to a constant balance. The amount of depreciation declines from year to year, and the price of the asset is fully amortized over the service life. It appears immediately that the major problem in dealing with this method of depreciation will be in finding a generalized expression for the changing rate. We can see that some of the same symbols will be useful in investigating this type of depreciation. They are repeated here for convenience:

- A — Price of the asset.
- B — Net balance at the end of any year.
- D — Depreciation accumulated in any number of elapsed years.
- D_x — Depreciation taken in any particular year.
- E — Elapsed number of years.
- N — Service life in years.
- r — Depreciation rate.
- x — Any particular year during the service life.

In addition, we will need the following symbols:

- r_x — The rate in any particular year.
- L — The latest term of an arithmetic progression.
- M — The average of a group of numbers.
- R — The accumulated depreciation rate.
- S — The sum of an arithmetic progression.

We begin with the denominator of the rate fraction, which consists of the sum of all digits up to and including the number of years of service life, and reverse the order of the numbers:

(1) $1 + 2 + 3 \ . \ . \ . \ + N$

We observe a regularity in the sequence in that each term differs from the preceding term by $+1$. We know, therefore, that the denominator consists of an arithmetic progression, and a convenient equation for the sum of such a progression, tells us that it equals the product of the number of terms, N, and the average, M:

(2) $S = NM$

The average term—the number midway between the highest and lowest terms, that might also be called the midpoint—is found by adding the highest and lowest terms and dividing by 2:

(3) $M = \frac{1 + N}{2}$

Substituting (3) in (2):

$$(4)\quad S = N\left(\frac{1+N}{2}\right)$$

Equation (4) supplies us with a brief computation for the denominator of the rate fraction.

Casting our eyes down the rate column of Exhibit 2, we note that the numerator can be described as the latest term, L, in an arithmetic series whose first term is the service life, N, and whose common difference is (-1). There exists a formula for the latest term of an arithmetic series. In terms of our familiar symbols it is:

$$(5)\quad L_x = N + (x-1)(-1)$$

$$(6)\quad L_x = N - (x-1)$$

And the rate fraction becomes:

$$(7)\quad r_x = \frac{Lx}{S}$$

Substituting equations (4) and (6) in (7):

$$(8)\quad r_x = \frac{N-(x-1)}{N\left(\frac{1+N}{2}\right)}$$

Multiplying both numerator and denominator by 2:

$$(9)\quad r_x = \frac{2(N-(x-1))}{N(N+1)}$$

Example: The depreciation rate for the fourth year of an asset having a service life of five years is:

$$r_x = \frac{2[N-(x-1)]}{N(N+1)}$$

$$r_4 = \frac{2[5-(4-1)]}{5(5+1)}$$

$$r_4 = \frac{2(5-3)}{5\times 6}$$

$$r_4 = 2/15$$

Depreciation in any period is merely r_x times the price.

$$(10)\quad D = A\left(\frac{2(N-(x-1))}{N(N+1)}\right)$$

Having already compared the rates, the computation of depreciation will not be demonstrated.

Accumulated depreciation is the sum of depreciation taken in each year to date. Reference to the table shows that this amount can be expressed as \$1,000 $\times$ $\frac{5 + 4 \text{ etc.}}{5 + 4 + 3 + 2 + 1}$. The numerator consists of the sum of an arithmetic progression whose first term is the service life, N, and whose last term is $(N - (E - 1))$. The last term is based upon equation (6). Remember that $x = E$ numerically. We know the formula for the sum of an arithmetic progression. Substituting the appropriate terms:

$$(11)\quad S = E\left(\frac{N + [N - (E - 1)]}{2}\right)$$

The accumulated depreciation rate fraction is:

$$(12)\quad R = \frac{S}{N\left(\frac{1 + N}{2}\right)}$$

Accumulated depreciation is the product of the rate and the price:

$$(13)\quad D = RA$$

We know the formula for R:

$$(14)\quad R = \frac{S}{N\left(\frac{1 + N}{2}\right)}$$

Substituting equation (11) and (14) in (13):

$$(15)\quad D = A\left(\frac{E\left(\frac{2N - (E - 1)}{2}\right)}{\frac{N(1 + N)}{2}}\right)$$

Multiplying numerator and denominator by 2 and moving the E outside the parentheses:

$$(16)\quad D = AE\left(\frac{2N - (E - 1)}{N(1 + N)}\right)$$

This equation for depreciation to date (Formula 16) is much easier to use than it looks. A few experiments will convince the reader that he can readily perform the computations.

Example: The accumulated depreciation through the third year of an asset with an original price of \$1,000 and a service life of five years is:

$$D_x = AE\left(\frac{2N - (E - 1)}{N(N + 1)}\right) \qquad D_3 = 1000 \times 3\left(\frac{10 - 2}{30}\right)$$

$$D_3 = 1000 \times 3 \left(\frac{2 \times 5 - (3 - 1)}{5 (5 + 1)} \right) \qquad D_3 = 1000 \times \frac{8}{10}$$

$$D = \$800$$

It would be convenient to have a quick statement for the net balance at the end of any year. It can be readily derived, owing to the fact that the net balance equals price less accumulated depreciation.

$$(17)\quad B = A - AE \quad \frac{2N - (E - 1)}{N (N + 1)}$$

$$(18)\quad B = A \left(1 - E \left(\frac{2N - (E - 1)}{N (N + 1)} \right) \right)$$

Since this equation is nearly identical with (16), an example seems unnecesary.

As in the case of declining balance depreciation, simple algebraic equations express the techniques of SYD depreciation, but the equations are based on the arithmetic series instead of on exponents.

Both Interesting and Useful

To summarize the results of this investigation, algebraic equations have been found for the three important entities of depreciation accounting: the ending balance, depreciation to date, and depreciation in any year.

The derivation of the equations is interesting for its own sake. Declining-balance depreciation can be described as exponential and SYD depreciation as serial. If a practical justification is required, these equations can be employed for quick solutions to problems involving the behavior of the depreciation methods in future years, without performing tedious calculations for all intervening periods.

The author hopes that their demonstration will stimulate an awareness of the mathematical bases of accounting. Accountants, after all, deal with numbers, and they can expect to encounter traces of higher mathematics in their work.

Giving Attention to Accruals and Deferrals in Interim Reporting

by JOHN V. VAN PELT, III

IF ACCOUNTING, as a means of evaluation of transactions by throwing out variances, and the related art of budgetary control are to serve as valuable tools, the basic accounting theory which underlies the record keeping must be sound from month to month.

In addition to internal operating controls there are public requirements as to the adequacy of interim accounting. There is a responsibility of reporting to security holders on an interim basis. Interim earnings reports may cause individuals to make ill-advised purchases or sales of our securities. Even legislation may be predicated on the results of periodic operations of a multitude of corporations. Managements will determine investment decisions and dividend action on interim reports. Many corporations have experienced the impact of budget cuts on the release of withheld budgeted funds because of fluctuations in earnings results for less than the annual period. Progress towards attainment of earnings levels which govern payments of incentives may even affect employee morale. Interim earnings may have an impact on labor negotiations.

These are important considerations. The handling of accruals and deferrals can have a tremendous impact on annual earnings. It is only proper, then, that the principles to be applied at year end should govern the results issued to managements and to the public from month to month on consistent basis. This paper will cite a variety of problem areas. The solutions are dependent largely on judgment. The discussion will be divided into four segments, dealing with the reflection and evaluation of revenue, the proper charge of costs and operating expenses to earnings, interim accrual for income taxes and, finally, interim provision for management incentives.

Reflection and Evaluation of Revenues

The recording of an account receivable generally marks the point at which

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profit should be accrued. The time at which this profit should be accrued is generally when title passes. However, pressures induced by sales departments or customers at certain periods of the year may result in the use of such devices as bill and hold, deferred billings or other similar mechanisms. Under such circumstances the accruals or deferrals of revenue that would result may not be correctly reflected.

At the time an account receivable is recorded, an effort must be made to adjust the reflected profit on the transaction for amounts of the recorded receivable that will not be finally collected. This is done by estimate of various deductions which will be ultimately taken from a series of similar transactions. Where conditions are applicable, provision should be made for cash discounts, losses on returned goods and uncollectable accounts. Where the amounts are significant, one should be constantly alert to the basis on which current provision for these items is being made. At times when business conditions tend to minimize the required allowance, in order to alleviate the pressure on periods of poor business, it would not be proper to over-accrue amounts provided. If business trends change within a year, provisions should be tailored as closely as possible to the evaluation of profits arising from current transactions. Reactions to business cycles in respect to these items may differ. For example, fewer cash discounts will be claimed in times of depression, but bad debt losses will mount.

Age of receivables is not the soundest basis of determining the amount that should be provided for future bad debt losses. This primarily tests the adequacy of actions that were taken or should have been taken long before. Adjustments should be made from time to time, and not necessarily at year end, so that variances can be brought to light for correction over future operating periods. However, in many industries, the incidence of bad debt losses fluctuates violently and changes in the rate of provision should be carefully tailored to current conditions. The accountant who records the provision for losses on uncollectable accounts must keep in close touch with the economist and credit manager, so that he can evaluate properly the risk factors inherent in the times or in individual transactions. It is difficult to apply sound judgment to the standard category of receivables; however, it is not so difficult to spot and evaluate the instances where credit risks are extended in individual cases or to new classes of customers. Evaluations, to be of the greatest worth to management, must be broken down by merchandising lines, since decisions are not made on an over-all basis.

In many instances the billing to the customer is not concurrent with the accrual of the related income. Subscription income, unredeemed tickets, unbilled utility revenues, cost-plus contracts where costs are determined on an annual

basis, or construction contracts, are all examples of this form of accrual or deferral in revenue accounting. While the accounting would generally appear to be simple in all of these cases there are many instances in which interim results have been grossly misstated because of improper handling. The greatest pitfall in the handling of unredeemed tickets and unbilled revenue, lies in a tendency to ignore seasonal fluctuations in business activity, by the simple route of establishing a fixed sum as the deferred or accrued portion of revenue. If the item is significant enough to merit special treatment in the first place, the instance would be rare in which the seasonal variation would not be significant. Measurement of the deferred or accrued revenue can always be accomplished by statistical analysis, sampling, or other means, but the accountant must have his wits about him. For instance in measuring unbilled revenue, daily send out is not necessarily the whole answer, because unit billings vary markedly from one class of customer to another and the consumption for various classes can vary widely by season.

Interim revenue accruals for cost type contracts present problems. Usually overhead absorption and joint centers are split on annual activity. Interim billings are generally at predetermined fixed amounts with the final adjustment being left to an audit after the close of the year. Current revenue accruals can be made only on the basis of detailed and conservative analyses of variances and budgets. Subsequent audits always seem to indicate that some allowance has to be made to the customer. This does not presuppose that the supplier was attempting to cheat the customer but, obviously, costs not claimed will not be allowed.

Construction contracts on a percentage-of-completion basis present even greater problems. In the industry it is an accepted practice to unbalance the bid, i.e., to apply to those segments of the contract to be first completed the larger portion of cost. As a result, the general practice among the smaller units in the industry of accruing income on the basis of estimation fails to make adequate allowance for such costs as moving out, winter shutdown or finishing up. Too often these costs can turn into a loss a project on which profits have been accrued. It is this practice, widely followed by many in the industry, which makes percentage-of-completion accounting a dangerous practice.

Proper Charges of Costs and Operating Expenses to Earnings

Most individuals are prone to think of deferrals and accruals in terms of expenditures, rather than revenues. Of course, in manufacturing companies the bulk of expenditures is subject to deferred accounting treatment, because in-

ventory and property are, in a going business, merely deferred charge accounts. Except for some comments regarding "lifo" accounting, this paper will deal with the accrual or deferral of expenditures in general, rather than methods of accounting for capital expenditures or inventory accounting.

There is a tendency on the part of accountants who have been conditioned by past experience under year-end audit conditions, to hold open records at year end to record all income charges handled as normal lap-over items during the year. This, in the first place, results in the distortion of operating results for two accounting months. Secondly, if the company issues interim reports during the year, similar treatment should be applied at the close of three other quarters.

Generally, goods and services should be accounted for upon receipt. The legal point of transfer of title, if such time differs from actual receipt, should not be governing unless there are amounts involved that could have a significant impact on the financial condition of the company, in which case accruals should be made every month.

There are two classes of expense on which it is difficult to do a very good job. First are the advertising costs which are generally prorated throughout the year on the basis of budgets, with the expenditures purportedly controlled under some form of appropriation accounting. Every company which has extensive media costs, has problems. Revenue estimates, which serve as the basis on which amortization is computed, turn out to be faulty, or the costs themselves are incorrect. For example, cooperative advertising bills are often completely uncontrolled. This paper makes no effort to offer a solution to the problem, except to hazard an opinion that too much attention is paid to the fiscal year, and there is insufficient inclination to carry prepaid advertising costs over a year end.

The other class of expense is legal expense. Where the lawyers fees are high, the accountant is usually guessing as he accrues from month to month. The lawyers should be requested to render statements quarterly, thereby permitting a more adequate provision for their costs on a current basis.

For those who cost inventories on a "lifo" basis, there are problems in the handling of accruals when inventories decrease after the beginning of the year. One is faced with the problem of inventory restoration and there must be set up in the accounts from month to month an estimate of the excess amount that will be spent for goods as compared with the amount at which such goods will be placed in the inventory. The resultant charge to income merely brings current operations up to the level of current or projected prices for the materials which have been borrowed. In addition, "lifo" accounting may require accruals toward the year end to prorate projected "lifo" adjustments, due to pricing

differentials on inventory increases. The proper interim handling of "lifo" adjustments can be effected only if the accountant has established sound and relatively accurate budgeting. To the extent that the price trend has been misjudged, the accountant may find that he has some very difficult explanations to make with respect to his "lifo" adjustments and he may also confuse his management insofar as the interim results of profit and loss are concerned. One of the reasons for use of a qualifying notation which often appears on interim statements can be traced to problems in the establishment of accruals for "lifo" accounting during the course of the year.

Maintenance expenses within a year can have a significant impact upon periodic earnings. For this reason, in preparing budgets, the anticipated timing of maintenance programs should be sufficiently detailed to permit apportionment of the related charges over the periods to which they are applicable. In this connection maintenance expenditures should be deferred over a year end, which is to say that equalization within the twelve-month period of a year is not necessarily a satisfactory handling. As an example, the aggregate business in the northern regions of the United States does poorly during the winter months from the standpoint of customer revenues. The operator rehabilitates his equipment during this period, generally starting in December, so that he will be in readiness for the forthcoming year. The costs that he incurs in this work are costs of the production of the aggregates that he will sell to his customers in the following year. These costs should be prorated on a tonnage or some other basis over the operations of the year when the equipment is to be utilized. While use of a natural business year starting in November or December might cure this problem in terms of annual accounting, it would not resolve the problem for interim statements. Conservatism in balance sheet presentation is the argument normally presented in opposition to deferral of such maintenance expenditures, but how else can one apply these costs against the revenues which will be obtained from using the rehabilitated equipment?

It might be contended that the cost of maintenance of the type described should be chargeable to the operating periods in the earlier year rather than in the following year. As a matter of practicability, it would be impossible to formulate an adequate estimate of the maintenance program in order to provide for its apportionment over the earlier operating period. So long as a peak operating period is being charged with its proper proportion of the maintenance, there is a reasonable statement of income during such a period. However, when a business is first started up, the initial period of operation may not bear its full proportion of charges but it is easy to assume that over-all operating costs will be at a lower than normal level, since the wear and tear on new

equipment should not result in as large a charge to that initial period as would be the case in subsequent peak operations.

The determination of the period to be charged may vary in differing instances. Such variation may lead to anticipation of the maintenance expenditures as well as their subsequent amortization. The proper decision requires a close scrutiny of the transaction to appraise the relationship between related revenues and costs. An example which is diametrically opposed to the seasonal program just mentioned may occur when major components of an asset have long lives but will be replaced more than once during the useful depreciable life of the asset. Under these circumstances accrual should be made for the replacement of the component subject. This is the practice that is still prevalent in the utility industry where boilers may be relined every three years and the cost of relining is accrued from the date of first usage of the boiler on the theory that a reserve of adequate proportions will be available to provide for the cost of relining when the cyclical period is completed. These examples indicate that a matter of judgment is present in the proper method of handling accruals or deferrals in these areas.

Interim Accrual for Income Taxes

In terms of net income most of the items dealt with above have been relatively insignificant when they are finally looked upon in the light of the income tax provision. How does one arrive at an interim accrual of income taxes? This question is most important if earnings are to be reported to the public on less than an annual basis. It is difficult to compute with any degree of exactitude the aliquot proportion of the annual income tax that will be due for the specific year. In most cases, tax depreciation is not really susceptible to computation on a month-by-month basis and, unless the books and tax return are both prepared on a cash basis, the bases of accruals and deferments which are followed will generally differ significantly. Of course, in most large corporations, the annual accrual is just as difficult to determine.

Under the circumstances, how does the accountant state his income tax provision properly month by month throughout the year? A detailed budget is the first essential. With this tool it may be possible to forecast, with some degree of accuracy, the probable differences that will exist between book net income before taxes and taxable income. These differences must be spread back over the months of the year on some intelligent basis and then liberal doses of good sound judgment must be applied at the time that each month's accrual is developed. It is clear that when specific transactions are entered into that

lead to tax deductions, the benefit from these should be reflected in the months in which they arise.

Any annual accrual for income taxes should include some provision for a cushion for disallowances, and these should be spread back over the months of the year. Accruals should be conservatively computed in the earlier parts of a fiscal year, just so that unexpected and unpleasant occurrences at the end of the year can be somewhat softened. When a corporation, either through its own past operations or because of the acquisition of some subsidiary, has a major tax loss carry-forward, an item of this nature should be spread rateably over the year, rather than used to extinguish all tax accruals in the early months. Again the rateable spreading should be done on the basis of budgeted figures. Budgets used for the evaluation of tax accruals should be revised during the course of the year and corrections resulting from prior variances should be spread over the remainder of the year in equal portions.

The accrual of taxes is one of the principal reasons for the qualification of interim statements. In this connection there is no greater accuracy at year end so far as determination of the final tax for the year is concerned than can be obtained at the interim periods during the year. Allowance for the settlement of questions which the agents may raise on review must be made and for this reason the year-end provision is not a known and ascertainable amount.

Interim Provision for Management Incentives

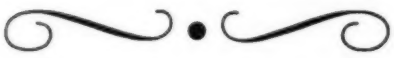
There is one other accrual that should be touched upon. Many incentive plans are predicated upon year-end results and yet, clearly, accruals for the ultimate liability should be made on an interim basis if net income is to be properly reported to security holders. These accruals must be based upon budgeted performance adjusted from time to time through the course of the year as actual performance deviates from the budget.

Summary

It is apparent that the accountant, whether public or private, has a responsibility for matching revenues with related expenses. This is the basis of the accounting and is accomplished by accruing or deferring revenues and expenses. To avoid being placed in the position of responsibility for the accounting records, the public practitioner should make sure that the corporate accountant applies in his interim accounting those principles which are applied at year end. Moreover, by so doing, the accounting records attain maximum utility to the management.

Generally, this paper has not attempted to describe how to make accruals; the primary purpose has been to point out situations where practices geared to the evaluation of year end financial statements do not provide satisfactory answers for the month-to-month accounting requirements and, additionally, to touch upon some situations where there may be a tendency to overlook the need for application of accounting techniques in properly reflecting the impact of revenues and expenses by accounting periods.

If one adopts an intelligent approach to interim accounting it should be possible to issue statements to the public that do not contain qualifications of the management's ability to apply sound accounting principles during the course of a year.



Toward Variable-Base Fixed Asset Accounting

by WILLIAM M. YOUNG, JR.

THE 87TH CONGRESS will undoubtedly be asked to alter those sections of the 1954 Internal Revenue Code having to do with depreciation of fixed assets. The pressure for change has been present in varying intensities in nearly every session of Congress since the Federal income tax was first adopted 47 years ago.

Original-Cost Theorists

Original cost as the base for depreciation is embraced by a large number of accountants (although the profession is divided), tax officials and, occasionally, some labor leaders. Although the bulk of the original cost advocates favor the liberalized provisions of the 1954 code, some would return to the cost and useful life concepts set forth in Treasury Decision 4422 and the first issue of Bulletin F, in 1934.

Among accountants, the original-cost theorists argue with some cogency that no legitimate substitute can be found for original cost, and that if fixed assets are to be given current cost treatment, then other assets, such as investments, must be given price-level adjustment, a task that is viewed as difficult.

Many also argue that equity capital is recovered in product cost, and that the investment in new equipment, regardless of its higher price, similarly will be recouped through setting higher prices for future products.

Charles Melvoin, an articulate original-cost advocate, argues that although inflation has induced some erosion of equity capital, to alter cherished accounting principles because of the vagaries of price-level fluctuations is mistaking effect for cause:

> ". . . one does not dispel the dangers of inflation or cure its evils merely by adopting a difficult accounting method. To attack accounting principles and practices because inflation and spiraling costs render difficult the obtaining of funds with which to reacquire the same or better facilities, is to mistake the effect for the cause, and to attribute the dullness of a tool to the ineptness of the wielder of the tool.
>
> "It should be remembered that to the accountant, the balance sheet is mainly a historical document which does not purport to show the realizable value of assets, even in cases where there has been a revalua-

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tion. There is nothing holy in giving effect to periodic appraisals, and, on the other hand, there is something of substance to be said for adhering to an expended cost, which has to be recovered over its useful life."[1]

To these arguments, the replacement-cost and current-value champions reply that within the accounting statement the dollars recorded are not comparable from one line to another—that the values given inventories valued on a "lifo" basis are not comparable to those given fixed assets, and that current assets and liabilities have no comparative relationship to book costs for plant and equipment. In short, the accountants who urge original cost are not consistent, treating current assets, especially inventories, one way, and fixed assets another. Moreover, to treat fixed assets differently, in effect, is giving the customer part of the capital accretion of assets without his paying for it. The current-value and replacement-cost advocates argue that there is little assurance that original cost is recovered in pricing of products, since in many companies accounting fails to embrace all elements of original cost, such as installation costs, and that, since the accounts deal only in original dollars rather than property units, remaining useful lives are not properly adjusted to take account of economic obsolescence generated by technological change.

Among tax officials, hesitancy about moving to current costs is easily explained in terms of fear of lost revenues, coupled with a reluctance to administer the uncertainties of price-trended asset values. Some opposition to changes in the depreciation formulas also can be expected from labor leaders who fear that depreciation reserves could be (and, they argue, are) used to absorb profits that otherwise might be distributed through wage and benefit increases.

Replacement Cost Advocates

The advocacy of replacement cost as the base for depreciation is not new. It reaches back to the 1920's, when economists, engineers, some accountants, and plant managers argued that the impact of inflation upon plant investment had the effect of eroding initial equity capital. Stephen McKenzie DuBrul, writing in the December, 1925, issue of *Management and Administration in Manufacturing Industries* noted:

> "It is true that this (accounting for replacement cost) makes financial accounting more involved and cost accounting even more so than financial accounting, but the results are worth the cost, *for they are true.*"

Modern replacement cost theorists launch a series of arguments related to

[1] "Depreciation in Accountants' Reports," Charles Melvoin, *The Journal of Accountancy*, November 1959.

the upward trend of fixed asset prices by which the initial investment in plant and equipment is debased. As illustrated below, to replace a 3½ inch fully automatic screw machine in 1960 would require 1.86 times the capital required 12 years ago. In other words, the dollars of 1960 buy only 53.7 percent of the screw machine equipment they bought in 1948.

PRICE CHANGES SELECTED DATES, XYZ 3½" FOUR SPINDLE FULLY AUTOMATIC SCREW MACHINE SAME MODEL, 1948-60*

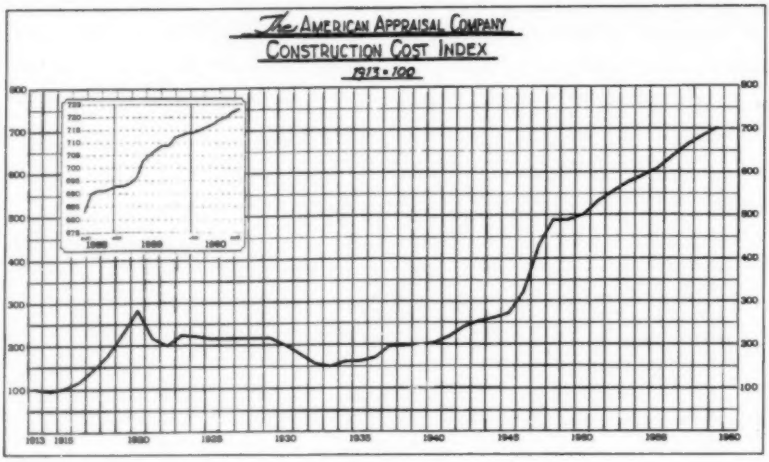
Year	Price New	% Increase over May, 1948
1948, May	$19,980	0.00%
1948, November	20,980	5.01
1950, May	24,200	21.12
1950, November	25,410	27.18
1953, November	25,410	27.18
1954, November	25,410	27.18
1956, May	28,950	44.89
1957, November	32,440	62.36
1960, May	37,240	86.39

What is observed in the case of the screw machine is true generally, if not more so, for all fixed assets. In reviewing a random sample of fixed assets appraisals made by the American Appraisal Company of medium and small manufacturing plants, we find that in the sampled cases, the mean original book cost of fixed assets is only 55.8 percent of their cost of reproduction new.[2] Capital erosion is suggested vividly by the figures.

Despite temporary downward business cycle swings that may reduce commodity prices and inventory values, fixed asset values have been upwardly mobile through most of the 20th Century. Exhibit 1 shows The American Appraisal Company Construction Cost Index for all years since 1913. In only eight of the 47 years covered by the index were construction costs downwardly mobile. These downward cycles occurred between 1920 and 1922, and 1929 and 1933. Since 1933, the index has moved sharply upward. It is most unlikely that costs will exhibit sustained downward trends in the coming decades. The national economy has several built-in stabilizers, such as unemployment compensation, social security, monetary controls and other devices, that tend to break downward tendencies, and the nation is committed to an expansive defense program that cannot but induce a gradually rising price cycle. Moreover, both major political parties are committed to a national economic policy of controlled in-

Data source: Sales quotations, The American Appraisal Company Mechanical and Equipment Pricing Department, Milwaukee, Wisconsin, 1960.

[2]Twenty-two cases selected at random from approximately 400 appraisals executed by the American Appraisal Company in purchase price engagements.



EHIBIT 1

flation. In the face of such policies, depreciation based on original cost will not be balanced out through alternating inflationary and deflationary price cycles, and the aggregate result will be the continued dissipation of capital in production.

Original-cost invoices become increasingly irrelevant to the recovery of capital in an industrial setting in which the rate of obsolescence is made unpredictable by sporadic and unexpectedly rapid technological changes. The introduction of magnetic tape control circuits on metal working machinery, for example, has suddenly made whole series of equipment economically obsolete. In the recovery of capital, the replacement of the property unit with an appropriate new one rather than the recovery of original cost becomes of prime importance if the productive aggregate of capital is to be maintained.

The use of replacement cost does not in fact fully recoup to industry the real dollars invested in equipment. As the price cycle moves upward, diversions to depreciation reserves in the years of an asset's early life are themselves dissipated through inflation in the later years of the asset's life. This is illustrated in Exhibit 2 in which various depreciation provisions are shown for an original cost of $1,000. Under the current replacement value concept, through which each year the present base is readjusted to present values and the current year's depreciation is taken against that new base, sum-of-the-digits produces a 30-percent deficiency and double-declining balance depreciation 29-percent deficiency as against full recovery.

Those concerned with the return of capital's full purchasing power suggest a full-recovery formula under which each year's depreciation includes an amount necessary to recoup the deficiency of the prior years. Thus, in addition to the annual provision regularly taken, an amount is also taken to offset the difference.

The Methods Change Advocates

Midway along the spectrum between the advocates of original cost and full recovery are shades of opinion that work for more rapid depreciation, but on an original cost base. It was this body of judgment that largely prevailed in the successful press for accelerated depreciation in the 1954 code. Faced now with greater inflation and more rapid technological change, this group now seeks a yet more liberalized methodology in calculating depreciation. They argue, for example, that the liberalized useful lives and methods provisions of Canada, would be better suited for capital recovery under present economic circumstances. Or they favor the selective use of short amortization periods, such as the 60-month schedule used in periods of national emergency. They point to the extraordinary liberal depreciation methods and their results used in Germany prior to World War II. Germany entered the war with a practically newly tooled machine tool industry and had more machine tools in repairable condition at the end of the war than did the United States, despite the havoc of bombings.[3]

The essential characteristic of this group is that they agree with the replacement-cost advocates in the necessity for telescoping the lag between capital expenditure and capital recovery, but they prefer to realize their goal through liberalized depreciation methods rather than through the full movement to a replacement-cost base.

Price Adjustment Administration

The principal arguments of those who oppose adjustment of book values for fixed assets to current values is that price adjustments are difficult to administer, especially in a modern industrial plant with hundreds or thousands of items of depreciable property.

From the point of view of an appraiser or a valuation engineer, however, the problem is manageable. Current and trended price information based on sustained and continuing analysis of new equipment costs and sales within the second-hand machinery market gives valid and fairly precise base information for repricing equipment already in place. With this information, the valuation

[3] *Effects of Depreciation Policy*, Gaston J. Frank, National Industrial Conference Board, New York, 1950, pp. 48-50.

EXHIBIT 2

Depreciation Provisions Under Selected Formulae

Year	Cost of Reproduction New at Year's End	Straight Line		ORIGINAL COST FORMULA Sum of the Digits		Double Declining Balance	
		Current Depreciation Provision	Total Depreciation Taken	Current Depreciation Provision	Total Depreciation Taken	Current Depreciation Provision	Total Depreciation Taken
1st	$1,100	$100	$100	$181.81	$181.81	$200.00	$200.00
2nd	1,200	100	200	163.63	345.44	160.00	360.00
3rd	1,300	100	300	145.45	490.89	128.00	488.00
4th	1,400	100	400	127.27	618.16	102.00	590.00
5th	1,500	100	500	109.09	727.25	81.60	671.60
6th	1,600	100	600	90.91	818.16	65.28	736.88
7th	1,700	100	700	72.73	890.89	52.22	789.10
8th	1,800	100	800	54.55	945.44	41.78	830.88
9th	1,900	100	900	36.37	981.81	33.42	864.30
10th	2,000	100	1,000	18.19	1,000.00	135.70*	1,000.00
		Deficiency = $1,000 or 50%		Deficiency = $1,000 or 50%		Deficiency = $1,000 or 50%	

*Includes $108.96 taken as capital loss in final year

EXHIBIT 2—Cont'd

Depreciation Provisions Under Selected Formulae

Straight Line		CURRENT REPLACEMENT VALUE FORMULA Sum of the Digits		Double Declining Balance		FULL RECOVERY FORMULA	
Current Depreciation Provision	Total Depreciation Taken	Current Depreciation Provision	Total Depreciation Taken	Current Depreciation Provision	Total Depreciation Taken	Current Depreciation Provision	Depreciation Required at Year's End
$110	$110	$199.99	$199.99	$220.00	$220.00	$110	$110
120	230	196.35	396.34	192.00	412.00	130	240
130	360	189.07	585.41	166.40	578.40	150	390
140	500	178.18	763.59	143.36	721.76	170	560
150	650	163.64	927.23	128.88	850.64	190	750
160	810	145.45	1,072.68	103.26	953.90	210	960
170	980	123.62	1,196.30	99.13	1,053.03	230	1,190
180	1,160	98.15	1,294.45	75.50	1,128.53	250	1,440
190	1,350	69.12	1,363.57	63.74	1,192.27	270	1,710
200	1,500	36.39	1,399.95	220.50*	1,412.77	290	2,000
Deficiency = $500 or 25%		Deficiency = $600.05 or 30%		Deficiency = $587.23 or 29%		No Deficiency	

*Includes $178.21 taken as capital loss in final year

engineer, applying his judgment based on observation of economic obsolescence, physical deterioration, and functional displacement, can establish with facility an appropriate, supportable current value.

It is doubtful that the accounting staff within a firm could maintain the technical pricing library needed to provide a continued flow of new value information. Because of this, it becomes more efficient to effect a wedding between the accountant and the consulting valuation engineer. In this wedding, the consulting valuation engineer identifies and prices equipment, and the accountant then administers the current values in the books of account.

In this process, all property items need not be given individual appraisal and accounting treatment. Large value, clearly identifiable units should be carefully controlled and given separate accounting attention. The identifiable, controllable property units are those whose identity will remain fairly constant throughout their useful lives, and whose value is high. These units, though small in number, constitute roughly 80 percent of the fixed asset value in the typical manufacturing plant. The rest of the property is made up of small items, low in unit value, whose identity not infrequently changes over their useful lives. These units are best given composite treatment, and the repricing can best be handled through periodic random sampling and pricing of units to re-establish current values. Through this method, the accounting and valuation problem does not become so cumbersome as to fall of its own weight.

The suggested property accounting requires sustained records management, and property verification to ensure that the books of account adequately reflect the property in the plant and periodic repricing. With these methods, the maintenance of property records for current value depreciation accounting is both feasible and manageable. Once such records are put in use, they have manifold application—in the tax work, insurance management, property custody, calculating the adequacy of depreciation reserves and retained earnings, product pricing, and maintenance and repair scheduling.

Conclusion

Should the present original-cost base for tax depreciation purposes be changed to a replacement cost, current value or full capital recovery formula, it is argued, accounting for fixed assets will be comparable to accounting for inventories, cash and work-in-process, since accounts will reflect present circumstances. Although many accountants view the application of price adjustment indices as cumbersome, the valuation engineer, working with the accountant in property accounting, can provide the data and records management needs for effective administration of variable-base fixed asset accounting.

The Effects of Combinations of "Fast" and "Slow" Depreciation on Reported Net Income

by CALEB A. SMITH

THE EFFECT of various combinations of "fast" and "slow" depreciation methods on reported earnings is not the same for all situations; it depends primarily upon the pattern of asset acquisition. In this article we will study three simple and widely divergent patterns of asset acquisition. The first pattern is that of a company which purchased its entire stock of depreciable assets at one time. The second pattern is that of a company which expends the same amount on purchasing depreciable assets each year. The third pattern is that of a company which in each successive year expends ten percent more on purchasing depreciable assets.

First Case—All Depreciable Assets Acquired Simultaneously

For our first illustrative case we will assume that a new company has been formed. Its assets, all with a 25-year life, were acquired at one time at a cost of $6,500,000. Assume further that net income before depreciation and Federal income taxes is $1,000,000 in each year. Under these circumstances what will be shown as net income on the company's reports? If straight-line depreciation is used, the depreciation is $260,000 each year, so net income before tax is $740,000. Using a 50-percent tax rate, the net income after Federal income tax is $370,000 each year. If sum-of-the-years'-digits depreciation is used, the depreciation in the first year will be $500,000, the net income before tax $500,000 and the income after tax $250,000, if no provision is made for deferred tax.

If the declining-balance method is used, starting with twice the straight-line charge, as permitted under the 1954 Internal Revenue Code, the net income after tax will be $240,000.

In the case of the company which purchased its entire stock of depreciable assets at one time, it is obvious that reports based on consistent use of straight-line depreciation (i.e., the use of straight-line depreciation on both tax return

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and report to stockholders) will show larger earnings in the years immediately following the acquisition of the assets than will reports based on consistent use of sum-of-the-years'-digits or other kinds of "fast" depreciation. Conversely the reports for the latter years if based on straight-line depreciation will show smaller earnings than the reports based on a "fast" depreciation method. Depending upon the nature of the assets and upon their use in the business, one or the other method of depreciation may be regarded as yielding the fairer picture of earnings. The choice of method, of course, should be based on an appraisal of the fairness of the resulting report. It is obvious, however, that promotional interests of the management may offer a different basis of choice.

The opportunities for a promotionally minded management do not stop with a simple choice of one or another method of depreciation as they do in the choice of a method of inventory valuation. Since there is no requirement that the same depreciation method be used in reporting to stockholders as is used for Federal income tax reporting, different methods of reporting on the return and on the report to stockholders may be combined. "Fast" depreciation may be used on the tax return and "slow" depreciation on the report to stockholders.

The reported net earnings after taxes for selected years using sum-of-the-years'-digits depreciation for the tax return and both "fast" and "slow" depreciation for stockholder reporting are shown in Exhibit 1. Since acceleration of the time for paying taxes will ordinarily be avoided, we will not consider the case in which some system of "fast" depreciation is used in reports to stockholders and straight-line depreciation is used on the tax return.

Exhibit 1 shows that if the company uses sum-of-the-years'-digits depreciation for its tax return and straight-line depreciation for its report to stockholders and does not make a provision for deferred taxes it will report $490,000 income after taxes in the first years as opposed to the $370,000 shown when it used straight-line depreciation on both reports or the $250,000 shown when it used sum-of-the-years'-digits depreciation for both reports. The use of the "fast" depreciation on the tax return and "slow" depreciation in the report to stockholders without any provision for deferred taxes makes the report to stockholders show $120,000 or 32 percent more income after tax than it would show if straight-line depreciation were used for both reports, and $240,000 or 96 percent more income after tax than would be shown if the sum-of-the-years'-digits depreciation were used on both reports. If the management of the company wishes to show these higher earnings it can probably discover some special circumstances which will justify making no provision for deferred taxes. It can then relegate the disclosure of the fact that it is using different depreciation methods to a footnote. The promotional opportunities are greatest in the first

EXHIBIT 1

Computations of Reported Income After Tax

Year	1	5	10	15	20	25
Income before depr. & taxes	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000
Sum-of-years-digits depreciation for tax return	500,000	420,000	320,000	220,000	120,000	20,000
Taxable income	500,000	580,000	680,000	780,000	880,000	980,000
Fed. income tax	250,000	290,000	340,000	390,000	440,000	490,000
Income after tax as reported to stockholders using:						
(a) Sum-of-years-digits depr.	250,000	290,000	340,000	390,000	440,000	490,000
(b) Straight-line depr. ($260,000 per yr.)	490,000	450,000	400,000	350,000	300,000	250,000

few years but, as shown in Exhibit 1, with a 25-year life for the assets as late as the fifth year, the "excess" in reported earnings is $80,000 or 22 percent if we regard the consistent use of the straight-line depreciation as the norm, or $140,000 or 48 percent if we regard the consistent use of the sum-of-the-years'-digits depreciation as the norm.

We may conclude that if the assets of a company were all (or mostly) purchased at one time, the use of "fast" depreciation for the tax return and "slow" depreciation for the report to stockholders will enable management to show a substantially larger net income after tax during the early years than would be shown with a consistent use of either "fast" or "slow" depreciation. If the life of the assets is fairly long, these higher reported earnings may be sustained for a number of years.

Would a rigid rule requiring that provision for deferred taxes be shown whenever "fast" depreciation is used on the tax return give uniformly good results with this pattern of asset acquisition? A provision for deferred taxes seems appropriate when "fast" depreciation is used on the tax return and "slow" depreciation on the report to stockholders, because earnings seem unduly high in the early years and unduly low in the later years if no provision for deferred taxes is made. On the other hand, use of the sum-of-the-years'-digits depreciation on both reports leads to a report of $250,000 income after tax if no provision for deferred taxes is made. Such a provision, if made, would reduce the earnings reported to stockholders to $130,000 after taxes. This seems unduly low. With this pattern of asset acquisition it would seem inappropriate to make a provision for deferred taxes when the same "fast" depreciation is used both on the tax return and on the report to stockholders.

Second Case—Equal Annual Purchases

For our second illustrative case we will consider a company that makes equal expenditures on new depreciable assets each year. For simplicity we will assume that all the depreciable assets it purchases have the same length of life. Under these circumstances, if the company had been using a given method of "fast" depreciation for at least as many years as the life of its assets, the total annual depreciation charge on all assets would be the same as the total annual depreciation charge under straight-line depreciation (or under any other "slow" method). Hence the consistent use of any method of depreciation will give the same results on the income statement. Furthermore, if the systems being used have been in use since the beginning of the life of all assets now being depreciated, any possible combination of "fast" and "slow" methods of depreciation

EXHIBIT 2

Computation of Reported Income after Taxes
Using Sum-of-the-Years'-Digits Depreciation on the Tax Returns for Assets Acquired After 1/1/54

Year	Depr.	Income before depr. & inc. tax	Taxable income	Fed. inc. tax	Income after tax* shown in report to stockholders using: Sum-of-years'-digits depr.	Straight-line
thru 1953	550,000	1,220,000	670,000	335,000	335,000	335,000
1954	595,000	1,220,000	625,000	312,500	312,500	357,500
1955	630,000	1,220,000	590,000	295,000	295,000	375,000
1956	655,000	1,220,000	565,000	282,500	282,500	387,500
1957	670,000	1,220,000	550,000	275,000	275,000	395,000
1958	675,000	1,220,000	545,000	272,500	272,500	397,500
1959	670,000	1,220,000	550,000	275,000	275,000	395,000
1960	655,000	1,220,000	565,000	282,500	282,500	387,500
1961	630,000	1,220,000	590,000	295,000	295,000	375,000
1962	595,000	1,220,000	685,000	312,500	312,500	357,500
1963 and after	550,000	1,220,000	670,000	335,000	335,000	335,000

* No provision for deferred taxes is made.

for tax return and stockholders report, if consistently applied, will give the same result as any other combination of methods.

Variations in reported income, however, will occur during the period of transition between the long continued use of different systems of depreciation. Column 1 of Exhibit 2 shows the total annual depreciation charges for a company that annually purchases $550,000 of depreciable assets with a ten-year life if the company used straight-line through 1953 and switched to sum-of-the-years'-digits in 1954.

Let us assume that the company has $1,220,000 net income before depreciation charges and Federal income tax in each year. In years prior to 1954 and from 1963 on, the depreciation is $550,000, the taxable income $670,000, the Federal income tax (using a 50-percent rate) $335,000 and the net income after depreciation and Federal income tax $335,000. This result is not dependent upon using a particular method of depreciation; any method which relates depreciation to time (rather than, for instance, output) if applied consistently for a period of years as long as or longer than the life of the individual depreciable asset will produce the same result.

Since the consistent use of any method of depreciation results in the same report of earnings, we may conclude that the earnings reported during the transition period as shown in Exhibit 2 (with no provision for deferred taxes) are unduly low if sum-of-the-years'-digits depreciation (or some other "fast" method) is used for both tax return and report to stockholders, and unduly high if "fast" depreciation is used for the tax return and straight-line depreciation (or some other "slow" method) for the report to stockholders. In the example developed in Exhibit 2 the excess or deficiency in reported net income after taxes falls between 16 percent and 19 percent of the "correct" figure for each of five of the nine years of the transition, i.e., the years between the third and the seventh year.

It is interesting to note that, if provision for deferred taxes is made, the reported net income after taxes is "correct" if the company uses sum-of-the-years'-digits depreciation for the tax return and straight-line depreciation for the report to stockholders but if sum-of-the-years'-digits depreciation is used for both reports, the provision for deferred taxes brings the already unduly low reported income after taxes down to an even lower figure. Under these conditions the reported income ranges from 31 percent to 37 percent less than the "correct" report during five of the nine years of transition, although after the transition the provision for deferred taxes will be self-cancelling and hence the reported net income after taxes will return to the "correct" figure. With this pattern of asset acquisition, the use of a provision for deferred taxes would

seem to be appropriate when "fast" depreciation is used on the tax return and "slow" depreciation in the report to stockholders but inappropriate when the same "fast" depreciation is used for both tax return and the report to stockholders just as it was with the first pattern of asset acquisition.

Third Case—Steadily Increasing Purchases

For our third illustrative example we will consider a company that makes steadily increasing purchases of depreciable assets. Again for simplicity we will assume that all depreciable assets purchased have the same life span. The depreciation charges in each year for a company whose asset purchases increase 10 percent each year and are at the $500,000 level in 1953 (in 1944 the purchases were $212,048.80 and by 1963 they will be $1,298,671.20) are shown below:

DIFFERENCES BETWEEN ANNUAL DEPRECIATION CHARGES WITH CONTINUED USE OF STRAIGHT-LINE DEPRECIATION AND WITH SHIFT TO SUM-OF-THE-YEAR'S-DIGITS DEPRECIATION FOR COMPANY WITH 10% ANNUAL INCREASE IN DEPRECIABLE ASSET PURCHASES

Year	Ann. depr. with continued use of straight-line	Ann. depr. if sum-of-the-years'-digits used for assets acquired after 1/1/54	Absolute difference	% by which sum-of-the-years'-digits depr. exceeds depr. under straight-line
1953	337,951	337,951	0	0.0
1954	371,747	416,747	45,000	12.1
1955	408,921	493,421	84,500	20.7
1956	449,813	567,763	117,950	26.2
1957	494,795	639,540	144,745	29.3
1958	544,274	708,493	164,219	30.2
1959	598,701	774,343	175,642	29.3
1960	658,571	836,777	178,206	27.1
1961	724,429	895,455	171,026	23.6
1962	796,871	950,000	153,129	19.2
1963	876,558	1,000,000	123,442	14.1

The annual depreciation charges for the company after a switch is made to sum-of-the-years'-digits depreciation for newly acquired assets exceeds the depreciation charges under a continued use of straight-line depreciation by an amount which increases rapidly during the early years of the transition. For this company, with fairly rapidly increasing purchases of depreciable assets, the excess is somewhat greater than the excess we found in the case of a company

EXHIBIT 3

Computation of Reported Income
Using "Fast" Depreciation * on Tax Return and Either
Straight-Line or "Fast" Depreciation * on Reports to Stockholders

Year	Income before depr. and taxes	Tax Return Figures Using "Fast" Depreciation *			Income after Taxes if "Fast" depreciation * Is Used on Tax Return			
					Straight-line depreciation on report to stockholders		"Fast" Depreciation * on report to stockholders	
		Depreciation	Taxable income	Tax at 50% rate	No provision for deferred taxes	With provision for deferred taxes**	No provision for deferred taxes	With provision for deferred taxes***
1953	750,000	337,950	412,050	206,025	206,025	206,025	206,025	206,025
1954	825,000	416,747	408,254	204,127	249,127	226,627	204,127	181,627
1955	907,500	493,421	414,080	207,040	291,540	249,290	207,040	164,790
1956	998,250	567,763	430,487	215,244	333,193	274,218	215,243	156,268
1957	1,098,075	639,540	458,536	229,268	374,013	301,640	229,268	156,895
1958	1,207,882	708,493	499,389	249,695	413,914	331,804	249,695	167,585
1959	1,328,671	774,343	554,328	277,164	452,805	364,985	277,164	189,343
1960	1,461,538	836,777	624,761	312,380	490,586	401,483	312,380	223,278
1961	1,607,692	895,455	712,237	356,119	527,145	441,632	356,119	270,605
1962	1,768,461	950,000	818,461	409,230	562,359	485,795	409,230	332,666
1963	1,945,307	1,000,000	945,307	472,653	596,095	534,374	472,653	410,933

*Straight-line on assets purchased thru 12/31/53.
Sum-of-years'-digits on assets purchased after 1/1/54.

**Same as net income after taxes with continued use of straight-line depreciation on both tax return and report to stockholders.

***Same as net income after taxes with continued use of straight-line depreciation on tax return and shift to sum-of-years'-digits on report to stockholders for assets acquired after 1/1/54.

with constant purchases of depreciable assets. In the case of the constant investment, the maximum difference, occurring in 1958, was between $550,000 and $675,000 of depreciation charges, or 22.7 percent, while with depreciable asset purchases increasing 10 percent per year the maximum percentage difference, which also occurs in 1958, is 30.2 percent ($708,493.40 instead of $544,273.90).

An even more striking and important difference, however, is that the depreciation charges remain permanently higher if "fast" depreciation is used. By 1963, and in all subsequent years as long as the 10-percent rate of increase in purchases of depreciable assets is continued, sum-of-the-years'-digits depreciation will lead to depreciation charges 14.1 percent higher than the charges which would be made under straight-line depreciation.

The extent to which depreciation charges under sum-of-the-years'-digits depreciation will exceed those under straight-line depreciation will depend on the rate of increase in the purchases of depreciable assets and the life span of the assets. If the rate of increase in purchases of depreciable assets is slower, the difference between the depreciation charges under the two methods will be smaller. Also if the life of the assets is shorter, the differences between the depreciation charges under the two methods is smaller. For example, with a five-year asset life and a 10-percent annual increase in purchases of depreciable assets, the difference in the annual depreciation will stabilize at a level 6.3 percent higher. When assets whose life is greater are considered, the difference will, of course, be greater.

Let us assume that the company whose annual depreciation charges have been illustrated had an income before depreciation and taxes of $750,000 in 1953 and that this income increases 10 percent each year just as its depreciable asset purchases increase 10 percent each year. If straight-line depreciation is used consistently, i.e., on both tax return and report to stockholders, the net income after tax is the same as that shown in Exhibit 3 in the sixth column when straight-line depreciation is used on the report to stockholders and a provision for deferred taxes is made. Similarly, the continued use of straight-line depreciation on the return while shifting to sum-of-the-years'-digits on the report to stockholders gives the same results as shown in the eighth column when the shift to sum-of-the-years'-digits depreciation is made on both the report to stockholders and the tax return and provision for deferred taxes is made.

The difference between the net income after taxes when figured in different ways is greater at the middle of the transition period for this company with steadily increasing purchases of depreciable assets than it was for the company

in our second illustrative case.* For example, the income reported to stockholders for 1958 if "fast" depreciation is used on the tax return but straight-line depreciation is consistently used on the report to stockholders and no provision is made for deferred taxes, exceeds the amount reported if straight-line depreciation is used consistently on both reports, by 24.7 percent in this case, while in the second case the excess was only 18.7 percent. What is even more significant, the differences persist even after the transition period is over. After 1963 the percentage level stabilizes and continues at this level as long as the purchases of depreciable assets continue to increase at the same rate. Under the almost universally accepted practice of depreciating on the basis of actual cost (rather than, for instance, replacement cost) the increase in depreciable asset purchases need not be the result of an increase in the physical quantity of the purchases; simply an increase in price, perhaps because of general inflation, will fulfill the conditions.

The midyear of the transition period, 1958, shows the greatest divergencies. In that year consistent continued use of straight-line depreciation leads to a $331,804 reported net income after taxes while a shift to sum-of-the-years'-digits for assets acquired after Jan. 1, 1954 on both tax return and report to stockholders leads to a $249,695 reported net income after taxes. This is a 32.9-percent difference. At the end of the transition period the difference between the report of income with consistent continued use of straight-line depreciation and that with a shift to sum-of-the-years'-digits depreciation on both tax return and report to stockholders for assets acquired after Jan. 1, 1954 has fallen to $61,721 ($534,374 — $472,653) a difference of 13.1 percent. Because of this persistent difference between the reports of net income even when different systems of depreciation are consistently used for a long period, we cannot identify any "correct" value for net income as we could in the second case. However, any report of income greater than that arising from continued consistent use of straight-line depreciation may be regarded as "high" and any report of income less than that obtained by continued consistent use of sum-of-the-years'-digits depreciation may be regarded as "low."

The reported net income obtained by the continued consistent use of straight-line depreciation is always a fixed percent (in this case 27.5 percent) of the income before depreciation and taxes. Since continued consistent use of sum-of-the-years'-digits depreciation gives a figure of 11.6 percent less than con-

* Variations in depreciation methods cause greater differences when depreciation is a larger part of income before depreciation and taxes. The income figures in the two illustrative cases were selected so that continued use of straight-line depreciation would yield depreciation charges which were the same percentage of income before depreciation and taxes for all years of both cases. Direct comparison of effects is then valid.

tinued consistent use of straight-line depreciation, we may also regard any reported net income which is more than 11.6 percent below that obtained by continued consistent use of straight-line depreciation as "low." By these criteria, use of a provision for deferred taxes with the use of sum-of-the-years'-digits depreciation on both tax return and report to stockholders may be regarded as leading to a "low" reported net income. Similarly, the use of sum-of-the-years'-digits depreciation on the tax return and straight-line depreciation on the report to stockholders may be regarded as leading to a "high", probably an unduly high, reported net income.

Conclusions

In actual practice, purchase of depreciable assets is not conformed to any one of these three patterns. The asset purchase behavior combines these patterns with a predominance of purchases conforming roughly to the third pattern but including purchases of assets with differing lives. Certain general conclusions may, however, be drawn as a result of our analysis.

First, the use of a provision for deferred taxes is inappropriate if sum-of-the-years'-digits or some other "fast" depreciation is used for the same assets on both the tax return and the report to stockholders.

Second, the report of income obtained by using "fast" depreciation on the tax return and "slow" depreciation on the report to stockholders is "high," probably unduly high, especially during the period of transition after the introduction of the "fast" depreciation. The use of a provision for deferred taxes would seem to be in order ordinarily although truly exceptional cases might occasionally make it inappropriate. While "lifo" inventory valuation may be used on the tax return only if used in all other reports, "fast" depreciation may be used on the tax return while "slow" depreciation is used on the report to stockholders. A company doing so reduces its taxes currently without incurring the disadvantages of reporting to stockholders reduced income before taxes. Furthermore, the current tax saving is seldom offset by higher tax payments in the future. Only in a business with a great initial bulk of depreciable assets and few replacement purchases will a combination of depreciation methods that leads to "high" reported net income in early years, result in correspondingly "low" figures in later years. Even this disadvantage will, in many instances, be bequeathed to a succeeding management and new stockholders as a negative legacy.

In a business which spends about the same amount on depreciable assets year after year, with no tendency for the amount to gradually and steadily

increase, making or failing to make a provision for deferred taxes affects the report of net income only during the transition period before all assets are being depreciated in the same way on any one report. After the transition period the method of reporting makes no difference. The penalty of "low" reports of income would come only if the business ceased to acquire depreciable assets at the same rate.

If these two sorts of asset purchase behavior were typical, it might be argued that since any promotional use of a combination of depreciation methods would produce only transient advantages it need not be rigidly restricted. This, of course, ignores the fact that promotional business behavior generally seeks advantages which can be gained in the relatively short run. In a dynamic economy, however, the typical business will be one which gradually expands its asset purchases. Under these circumstances, as we have seen, the combination of "fast" depreciation on the tax return and "slow" depreciation on the report to stockholders without a provision for deferred taxes, offers not only a greater advantage in the immediate future but carries on a sustained advantage.

Since the typical business situation is one from which both a short-run and a sustained advantage can be gained by the use of a promotionally chosen combination of depreciation methods, it would seem desirable to restrict the special circumstances which permit an exception to the A. I. C. P. A. rule (Accounting Research Bulletin No. 44—Revised), which requires a provision for deferred taxes when "fast" depreciation is used on the tax return. In line with our earlier conclusion this rule-change should specifically exempt cases in which the "fast" depreciation is also used in reports to stockholders.

Decision: Plant Relocation

by G. I. TEBBEL and R. B. MacGREGOR

ONE OF THE MOMENTOUS DECISIONS which may be faced by management at some time in the life of a company, is the decision to relocate. Often, all the forces and emotions of traditions established over the years must be broken—not only the roots of the corporation but also those of its people are then uprooted or at least shaken in their foundations. On the other hand, the sense of change, anticipation of better things in the future, and apprehension toward unknown future events lend an aura of excitement to the process of making this decision and subsequently planning the move. With larger companies these emotions are less dominant, but some trace is always present.

Companies have many reasons for considering a move: Limits of the existing site may no longer contain a growing concern. A policy of geographic decentralization may be under consideration or in effect. Poorly planned buildings, old equipment, high labor costs, shifting markets and new sources of raw material may place the company at a cost or quality disadvantage. An imminent purchase or merger may trigger interest in plant location. Relocation may be under consideration because the company is on its way up, or because it is on its way down. It may be offensive or a defensive strategy. Many are the reasons that precipitate plant relocation studies.

Similarly, the extent of the change varies considerably. An entirely new plant for all the company's operations may be contemplated. A division or product line may be split off from the main plant. Distribution centers, warehouses or geographically dispersed assembly facilities are often the elements under study. To add further complexity to the situation, several alternatives usually exist for the degree and method of change. A difficult task confronting the management team selected to direct the study is retaining objectivity despite these technical complexities and human relations problems.

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Financial Information; Preliminary Evaluation

Making the decision to move—or to stay—is a great responsibility, but it is also a rare opportunity. The changes contemplated are often so fundamental and of such great importance to all employees that many previously impossible improvements become feasible, even in that part of the main plant which stays behind. If the entire company is to be relocated, it may be possible to make a new start yet have a wealth of past experience from which to draw. Old policies, procedures, precedents, habits or technology need not apply any longer, and methods improvements that could not be effected previously may now be employed.

In order to make the most of these opportunities, the current situation and past history of the company must be considered in the proper prospective. The decision, when made, will be a long-term one. Immediate or short-term gains are of minor importance. A strong, clear view of future benefits must be evident to provide the only sound foundation for a decision to relocate. The markets of today may not be the markets of the future. The current source of raw materials may soon be exhausted. The current and historical arrangement of the company's other facilities, such as outlying warehouses, is not fixed and permanent but flexible. Changes in these related facilities may be appropriate. The management team, recognizing that opportunity exists and then thoughtfully proceeding with the study, can achieve creativity going beyond historical relationships.

Within the framework just outlined, the alternatives to be considered should be spelled out and the activities, to be performed under each, recorded. When these alternatives have been defined, the next task is to develop the information on which the final decision will be based. Although the reasons for considering plant relocation are many and the alternatives are complex, the justification is usually simply defined—improved return on invested capital. After all, the purpose of the corporation is to earn a profit for its owners. The principal information that must be gathered for the preliminary evaluation, therefore, is financial. The steps that are necessary in a plant relocation study may be stated briefly as follows:

1. Detail each element of current cost.
2. Determine changes in investment and operating costs.
3. Compile the one-time costs of moving to a new location.
4. Detail the complete specifications.
5. Choose the community and the plant site.
6. Make the final decision.

Usually a rather quick evaluation of profit improvement potential and investment is first made, to prove the feasibility of the proposed plant relocation study. If the preliminary decision is to proceed, then the detailed examination of the pertinent elements, as outlined above, is made. If the original decision is then reaffirmed, the move is in planning stage. The following paragraphs elaborate on this study approach.

Detail Each Element of Current Costs

Preparing a profile of current costs in some detail is of basic importance. This information is the common ground from which each alternative is to be measured. For preparation of this profile, a selection of cost elements pertinent to the plant relocation is developed. The current costs must reflect contracted or reasonably expected changes as fair bases of comparison. A point of departure for computing the attractiveness of each alternative is thereby defined. This profile is, in effect, a reference point from which to measure deviations. An equally important benefit of this data is to display the significance and, therefore, the opportunity for improvement, inherent with each cost element. High cost for bringing materials into the plant may suggest locating closer to the source of supply, particularly if the cost of shipping to customers is a minor consideration. Are labor costs of major importance? If so, which element is it, the "workers" or the "overhead"? Perhaps local and state taxes are significant. Sorting out costs in a way that is meaningful for the plant relocation study will usually suggest new alternatives to consider. Some of the techniques that can be used for this profile are:

Personnel. Prepare an organization chart showing all the supervisors. List by job title the number of office and factory workers reporting to each supervisor. If appropriate, include the average wage rates with this data. Pay roll is nearly always one of the most significant cost elements. A continual point of discussion will be the additions, deletions and other revisions to this list.

Raw materials. List the high annual dollar volume purchased materials indicating annual usage, average order size, and average inventory. The list should also include the source of the material. This data will serve as a basis for computing changes in inbound freight, transfer of inventory to the new site, changes in inventory investment, and changes in personal property taxes.

Distribution. Prepare a schedule showing the geographic destination of the product and the quantities. Define average shipments and compute sales dollar to cubic feet or weight relationships. With this data freight costs, product mix among plants, and other pertinent data can be developed. Careful con-

sideration must be given to the sales volume and destination data used. Perhaps long-range sales forecasts should be the basis for determining volume, while territory potential, rather than current experience, should be the basis for destination.

Machinery and equipment. List the book value and depreciation rate of all major machinery and equipment likely to be affected. As each alternative is evaluated, the items to be moved, scrapped, reworked or newly purchased are indicated along with the new book values and depreciation. This permits determining investment in new and modified equipment, changes in property taxes, revised depreciation, and other factors.

Expense schedules. Prepare a schedule for each significant tax, fringe benefit, utility cost, insurance cost, and other cost elements defining in basic terms the origin of the cost. This information is essential for evaluating differences in tax situations, labor rates, fringe policies, etc.

Operating ratios. Compute operating ratios, where appropriate, to be used for computing requirements at the new plant. For example, the relationships of work-in-process and finished-goods inventory to raw materials inventory may make a detailed analysis unnecessary.

In this manner all appropriate operating costs and balance sheet elements are laid out in a usable way.

Determine Changes in Investment and Operating Costs

In order to determine the change in cost and investment elements, the operations that are to be removed from existing facilities and those to be performed in new facilities must be defined. This definition will serve as the basis for determining the people, machinery, inventory and facilities required. Often forecasting a sales volume in detail and applying material and labor standards from processing sheets will yield this data. Listing from this the manufacturing operations to be performed and required machine loadings will further establish the needs. The machine load data also helps to set forth equipment and facility requirements. Further, the extent of clerical, sales, service, purchasing, engineering and other operations to be performed at the new location must be determined.

Several geographic locations that appear to be appropriate should be selected. A review of competitors' locations in addition to consideration of the cost profile may be of value for this. The wage rates, prevailing fringe benefits, state and local taxes, inbound and outbound freight, and other factors, should

be determined for each location. This type of detailed analysis is continued for each alternative until assumptions and computations are made covering each pertinent cost element. The analysis must include not only the additions at the new location but also the deletions from the existing situation.

A common problem in partial relocations is failure to cut back supervision, indirect labor, inventory and other cost elements at the main plant when the partial move is executed. Another problem arises from evaluating the alternatives on the basis of the past instead of the future. Some cost advantages result from short-term circumstances. In some cases this might be true for wages and taxes. Others are inherent, such as transportation costs. It is important to recognize this difference.

The computation of operating cost changes and additional investment required are inseparably related. For example, before changes in personal property taxes can be determined, the reduction of inventory and equipment at the main plant and requirements at the new location must be known. Similarly, knowledge of the cost of the new facilities must precede estimating depreciation for the new plant.

Compile the One-Time Costs of Moving to a New Location

Another major element to be considered is the one-time costs—those abnormal costs attributable to moving all or part of a plant to a new location and starting production with a new work force. These costs are not normal operating costs and, therefore, must not be co-mingled with them. However, like regular operating costs, they are expenses chargeable against operations, which will decrease profits for a short period of time. Therefore, they must appear in profit projections.

Neither can one-time costs be considered capital investments in the traditional sense, so they cannot be lumped in the investment schedules. However, like the additional investment that will be needed, these one-time costs represent a large cash outlay above the normal operating requirements. Therefore, the one-time costs should be included with investments in schedules of cash requirements. Knowing the extent of these costs in some detail is particularly essential when borrowing is required to finance the move.

Some examples of one-time costs are moving expense for key employees and their families, temporary living and travel expenses incurred by company personnel assigned to start the new operation, separation pay for released personnel, temporary extension of insurance benefits or other consideration for released personnel, temporary excess product cost from substandard productivity and

quality while the personnel in the new plant are learning their jobs, cost of training new employees, disconnecting, moving and installation expenses for machinery, equipment and inventories, and handling and financing costs associated with a build-up of finished goods inventory to cover the change-over period. Recognition of possible significant differences in one-time costs between the communities should require separate determination for each of them.

The comparison of the investment, operating cost and one-time cost data will set forth the financial attractiveness of each alternative. If, after this preliminary investigation, it is believed that the plan to move is feasible, the alternative to be pursued should be selected.

Detail the Complete Specifications

Up to this point the accumulated financial data is based upon judgment, estimates, and rough calculations in some instances. It is now time to become more precise. The scope of the study should be enlarged and detailed assignments made. In addition, general specifications for plant, plant site, new operating procedures and community characteristics must be detailed. The process of detailing specifications is voluminous and complex. The result of the detailed specifications is the description of the desired plant and equipment, building site, community factors and relationship of the proposed plant with the rest of the organization.

The machine load charts, process sheets, equipment lists, inventory requirements, production forecast, and other data previously compiled for the preliminary survey will serve as an excellent starting point for preparing specifications for the new plant. At this point of the study, major emphasis should be placed upon the opportunities for improving operating techniques, work flow and other facets of the manufacturing process. In addition to strictly manufacturing considerations, these specifications should include a complete definition of utilities requirements, disposal of wastes, transportation requirements, parking facilities, unusual structural or facility requirements and similar details. In specifying the plant and plant site, the manufacturing group must keep in mind the requirements for long-term expansion and provide for it. This data should be translated into a plant layout and, ultimately, the architects' and engineers' design of the new building.

As the building specifications are developed, information will become available for the second area in which particulars are needed, defining a satisfactory building site. Site size should be predicated upon future requirements and provide sufficient room for parking and expansion. Good transportation facilities,

including availability of main highways, railroad sidings, air transportation and modern postal service, are essential. Necessary facilities of the site area, including roadways, water lines, sewage connections, power and gas lines, should be planned. Of particular importance are the capacity of the utilities compared to projected future requirements and the restrictions placed on their use. Many not so obvious factors must be known, such as soil mechanics, flood history, grade and drainage, zoning restrictions, and other technical considerations.

The third area in which detail is required is in specifying the desired community. Examples of business factors which the community specifications might include are utilities, commercial services, waste disposal facilities and restrictions, community size to furnish an adequate labor supply, quantity of labor supply available for employment, transportation facilities, prevailing fringe benefit policies, climatic conditions, tax emphasis, and others. Community specifications should also include evaluation of those factors that make it a desirable place to live. Suitable housing, convenient shopping districts, ample professional services, adequate schools and churches, and diverse recreational and cultural activities are important community factors. Condition of streets and other public properties, out-of-the-ordinary community projects, general condition of homes and business properties, and evidence of future planning are indicators of community spirit. In summary, the specifications should be sufficient to assure management that the new community will be a good place to locate a business as well as a good place for employees to live.

A fourth area requiring specifications is operating procedures and policies. There is no specific list of things to consider that describes this area. Rather, the intent of this portion of the planning is, first, to capitalize on the opportunity of a fresh start and, secondly, to define relationships with the other company operations if the move is less than total. Each phase of company operations requires examination.

In the excitement of planning the new plant, consideration of the effect on the old plant is sometimes neglected. The disposal of buildings and equipment, dislocation of people, redefining of main plant operations, and other factors must be considered. The determination of new specifications for the old location is extremely important.

Choose the Community and the Plant Site

After the plant and community requirements have been established, the selection of areas which meet the specifications for favorable labor rates, sources of raw materials, and other desired features can be made. The nature of these

requirements will define the geographical boundaries of acceptable territory, which may cover a large or small area. The general area can be further reduced by elimination of communities which obviously lack key requirements. After a list of candidate communities has been prepared, the investigation should be continued by visiting these communities. This is usually done without revealing the company name. The most important contact to be made is with other companies in the community, since they will be frank about all conditions. Banks, government officials, Chambers of Commerce, state and local industrial development agencies, residents, utility companies, and transportation companies are some of the other sources of good information. From them the field investigator can learn about existing or planned industries, labor rates, practices, availability, ability and attitude; living conditions; utilities; transportation availability; tax rates and trends; local financing; site availability and cost; and many other details. Since community pride often influences the opinions of persons interviewed, cross-checking of answers received is desirable. After these visits, the number of acceptable candidate communities can be narrowed to a few by detailed analysis and comparison of findings.

Of course, the community must have a plant site available that meets the specifications. Prices, descriptions and all other pertinent facts must be determined and recorded for later comparison with other communities.

Make the Final Decision

At this point the operating costs, the one-time costs and the possible savings for each of the acceptable communities should be recalculated. The areas of regular costs which may produce savings or added expense in the new community are usually in the following categories: raw materials, pay roll and fringe benefits, taxes, freight in and out, utilities, telephone and telegraph.

When the final location decision is made, the long-range objectives should once more be reviewed to ensure that final selection is based upon long-term gains rather than temporary savings. This is necessary since very important conditions or trends may exist which cannot be expressed in dollars and cents at the time of the study. For example, a strong and unfavorable union movement may be gaining impetus in the area, key raw material sources may be near depletion, or tax rates may be overdue for upward revision.

Reliance on estimates of one-time costs and operating savings admittedly involves some risk. For that reason this final summation should be based on thoroughly examined, detailed facts rather than judgments, assumptions and rough calculations. Indeed the principal difference between making the pre-

liminary decision to proceed and the final one is the conversion from a basis of reasonable judgment to one of sound, factual analysis.

When the Decision Has Been Made . . .

The intent of this summary presentation is to outline the general process of gathering the necessary facts and figures to make the final decision for relocating all or part of a company's operations. The additional steps that must be taken once the move is decided are substantial. The mentioning of a few of these will indicate that when the decision to move is made, the plant relocation operation is just well begun. Obtaining financing, buying a site, building a plant, planning good customer service during change-over, mapping personnel strategy and befriending the new community are some of the most important matters to be considered in the planning stage.

Control of Capital and Unusual Expenses

by JOHN B. THOMPSON*

FOR A NUMBER of years our company has used successfully a very simple but effective means of providing management with statistical data designed not only to be informative but also to serve as a tool for controlling capital and unusual expenses. The results of a recent survey on this subject were surprising in that it indicated that many small companies, and even some of the medium and larger organizations, had at best a very informal program for co-ordinating and applying effective control to these two items.

Our program is designed to meet the complexities of a parent corporation and two operating subsidiaries, with seven plants in three states. Financial control for the entire organization is maintained in the general office of the parent corporation. While a system of control is essential in our case, the principles followed could easily be applied to a small business.

Capital Expenditures

We have two classes of capital expenditures which are distinguished only by the dollar amount of cost. Our plant managers can make purchases up to $5,000, but items in excess of this amount must be approved by top management. There is a special requisition slip completed by the plant manager which shows date, plant location, name of vendor, description of equipment, estimated cost, estimated time to complete, and a space for any remarks deemed appropriate. This slip is forwarded to our purchasing department, which checks price data and inserts any additional information considered important, such as alternate vendors, for instance.

If the total price is less than $5,000, including freight and erection charges, the purchasing department, subject to competitive bids and other standard procedures, issues an order. If for some reason a vendor other than the one recommended is to be used, clearance is obtained with the originating plant manager before the order is issued. The same day a copy of the purchase order goes to the accounting department for insertion of the general ledger account number, as well as the life to be used for depreciation purposes. At this stage, corrections are made for any errors on the part of the plant manager as to whether an item should be expensed or capitalized, and the copy of the purchase order goes back to the purchasing department for permanent filing.

The procedure is similar for items with total cost of more than $5,000 except that the requisition must be ap-

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proved by either a vice president or the president of the company, before the purchase order can be issued. If approved, the requisition goes back to the purchasing department, which processes the order, and notifies the plant manager of the action taken. Prior to approval of major items, the accounting department prepares a report showing the anticipated return on investment to assist the management official concerned in making his decision. A project number is assigned each item over $5,000, and prior to the end of each month the originating plant manager makes a report to the treasurer concerning the status of all open projects at his plant.

On the first day of each month a consolidated project report is prepared which shows the following information with respect to capital expenditures (over $5,000) by plants:

- Project number and brief description of item.
- Date approved.
- Estimated date of completion.
- Amount approved.
- Amount paid prior to current year.
- Amount paid during current year.
- Total amount paid.
- Balance remaining.
- Expense in excess of authorization.
- Balance to be cancelled.
- Remarks—including comments on any project on which cost exceeds authorization.

Completed projects remain on this report until the end of the year, at which time they are dropped. The reason for this is to give management a complete picture of the major capital items for the entire year. A supplementary schedule, showing all other capital expenditures (less than $5,000) by plants, is attached to the project report. This part of the report is less detailed but is added so that the overall report will be complete. Once each month the treasurer carefully reviews the entire capital expenditures report with the various echelons of top management.

Unusual Expenses

Every company has a category of so-called large or unusual expense items. With us these are primarily the various maintenance and related items which we call mill expense. Quite often one purchase order covers a substantial volume of mill expense items to be delivered over a period of months, and it is highly important that the status of such orders be known at all times.

Each of our plants has a weekly budget for mill expense. At the end of the week a report goes to each plant manager, as well as top management, showing the relationship of actual expenditures to the respective plant budgets. The mechanics for controlling these expenditures are somewhat similar to those described for capital expenditures. Each plant manager can on his own responsibility make purchases not in excess of

$1,000. Above this amount, approval must be obtained from an officer of the company before the order can be placed. Our purchasing department is charged with the responsibility of policing the program to discourage any attempts to bypass special approval by breaking a large order into a series of small orders.

After the proper approval, each order of $1,000 or more is entered on what we call our unusual expense report. This report shows purchase order number, brief description of item, vendor, date approved, amount paid in previous months, amount paid during current month, total unpaid balance, and a proration of the remaining balance over the future months in which deliveries are anticipated. As soon as the purchase order is completed and the invoice approved for payment, that particular item is automatically eliminated from future reports. This report is carefully reviewed each month by the treasurer with top management.

The actual preparation of both the capital and unusual expense reports is simple and can be done by clerical personnel. These reports provide a complete picture to management and have a historical as well as current value. Some of the uses of the reports are as follows:

1. More accurate planning and control on part of management; projections shown by reports make possible long-range comparisons with budget.
2. The two reports described eliminate the necessity for numerous special reports bearing on the same subject.
3. Considerable assistance to purchasing department in handling follow-ups with vendors.
4. Provides top production executive with current status of all commitments and enables him to make adequate arrangements for scheduling arrival of equipment.
5. Considerable assistance to accounting department as reference for various related reports serves as an accurate source for setting up and accruing depreciation on current capital additions.
6. Aids cost department in revising and keeping standards on a current basis.
7. Makes it possible for the treasurer to anticipate cash requirements more accurately.

Most industries and businesses are currently facing a combination of intensive competition and a somewhat depressed economic situation. Obviously, under such conditions, management is going to turn a spotlight on control of both capital and unusual expense items. As an accountant, why wait until requested to review and take action with respect to this problem? If your company's program for handling these items is too informal or, in your judgment, inadequate, this is a wonderful opportunity to enhance your value as a member of the management team.

Current Concepts of Internal Auditing

by LAWRENCE C. RICHARDS

FOR MANY YEARS the job of internal auditors was synonymous with that of internal accounting controls and checks. The function and responsibility of the internal auditor was that of an accounting clerk, to perform an operational function of reviewing all invoices and vouchers for mathematical accuracy and proper designated coding. This function undoubtedly had a degree of significance in the days when an accountant's ability was measured upon his mental agility to add up a column of figures rapidly or mentally compute percentages. However, with the present adding machines, calculators and other electronic equipment plus the development of internal controls, this phase of review has become less significant.

Although in many organizations the internal auditors have progressed beyond the clerical stage, the true concept and value of internal auditing as a "tool" for management is not fully recognized by management nor utilized to the fullest extent. It is not unusual to find the internal auditing division functioning solely as a supplement to the public accountant's examination, restricted to details. Often the procedure and extent are delegated by the indirect supervision of an outside accounting firm; the internal auditor reviews those selected subsidiary companies, branch offices, sales and production divisions, and warehouses, which the public accounting firm is not reviewing during the year or period of examination. These examinations are performed under the direction and supervision of the public accounting firm in accordance with the prescribed audit program. Thus, the only purpose of internal auditing is seen in the verification and assurance that the figures presented on the financial and operating statements are substantially correct and that there are no irregularities in the accounts.

The utilization of an internal auditing division performing in the capacity of a supplement to a public accounting firm serves a limited purpose. From the standpoint of economy, the use of a centralized internal audit staff to perform out-of-town assignments is not always practical. Larger public accounting firms have developed branch offices in strategic cities or have arrangements with reputable associate firms in smaller communities.

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Present Stature of Internal Auditing

In this modern age, accounting, like any other recognized profession, has its specialized categories. Internal auditing becomes a special phase of administrative accounting and should not be misconstrued as an adjunct to the public accountant's examinations. Public accounting firms have become more conscious of internal checks and controls and, to a degree, cover some of these grounds. However, these reviews are limited by time available, fees and comprehensive staff training in one organization's activities. Thus we find that the independent public accounting firms are incorporating in their audit programs a review of the internal auditor's examinations. These reviews assist to ascertain the degree of detail verification of subsidiary records they may want to perform.

The similarity existing between public accounting and internal auditing examinations is apparent. The internal auditor operates with the same unbiased independence of thought and performance of duty as a public accounting firm does. In modern business the internal auditor's position has changed from a routine clerical job to that of an important member of management's staff. The internal auditor properly approaches his responsibilities from top management's point of view. No longer is he directly responsible to the bookkeeping or accounting department, but usually reports to the head accounting office of the company, and in many cases reports to the president of the company or even directly to the board of directors.

While it is true that many of the procedures of the internal auditor are patterned after those used by independent public accountants, the approach of the internal auditor is different. The public accountant is almost exclusively interested in the end results and the corrections of any errors disclosed, while the internal auditor is equally interested in the process of obtaining the end results and the prevention of recurrence of errors. Whereas the trial balance is the public accountant's guide and yardstick, the internal auditor uses not only the figures reflected on the trial balance but also a flow chart and a procedure manual of operations and policies. At this point it should be noted that the internal auditor goes beyond the scope of the public accountant and so justifies his importance and necessity to management.

Company-Wide in Scope

The scope of internal auditing is segregated into two types of investigation:

1. Functional audit—a review made of one function, or a part of one, on a company or corporation-wide basis and recommendations made for improvement based on the over-all review.

2. Responsibility audit—a review of all functions performed under one responsibility or location.

Specifically, the internal auditor's scope is:

1. To ascertain the degree of reliability of accounting and statistical data developed within the organization.

2. To ascertain the extent to which company assets are properly accounted for and safeguarded from losses of all kinds.

3. To ascertain the extent of compliance with established policies, plans and procedures.

4. To review and to appraise the policies and plans of the organization in the light of the related data and other evidence.

5. To review and to appraise the internal records and procedures of the organization in terms of their adequacy and effectiveness.

6. To review and to appraise performance under the policies, plans and procedures designated by management.

Although the internal auditor's scope can be relegated to a few principles, so vast is the field of internal examination and so interrelated is one operation with another, that it often becomes exceedingly difficult for an auditor to ascertain specifically where his responsibility ceases in auditing a particular operation. For example, the author recalls an instance in which an internal audit division was requested to perform a brief survey of a municipality operated under the jurisdiction of the company. On the surface this appeared to be a routine investigation of municipality records. However, the examination of the municipality reflected leases and property arrangements of other enterprises. Thus a routine examination developed into a review of a local theatre, a tavern, a drug store, a general store, a women's apparel shop and a construction company, plus a local hospital.

Another typical case which the author encountered was during a review of unrecorded liabilities. This is normally a routine examination, the main point being to establish date of passing of title of the material or property acquired. However, the simplicity was illusive in this instance. The work did not end with a mere reviewing of dates and title passing. The examination spread from accounts payable operation to a review of the purchasing department and eventually encompassed a review of the traffic division.

A good audit division does not operate solely within the accounting department's confines; it is available for functional examinations in which the protection of assets, revenue, or costs is a factor. This includes virtually everything which the company does, and all the company's departments. This does not

mean that an auditor is an industrial engineer, a metallurgist, or an industrial relation expert. However, it is surprising what a conscientious auditor with ingenuity, imagination and good common business judgment can disclose.

An internal audit examination should be of departmental operations, rather than individual balances reflected on the general ledger. These balances should not be overlooked, but more stress should be laid on how, where, when, who and what created the balance shown on the general ledger. Consequently, examinations from an internal auditor's point of view do not contemplate cash, on hand or in banks, but rather the treasurer's cash projections, forecasts, controls, procedures, authorizations, approvals and work performances.

A review of accounts receivable would not cease after verification of agreeing the balances of the subsidiary ledger with the control and reviewing individual balances over ninety days old; in addition, examinations would reach to billing procedures, calculations, mailing of invoices, then distribution, filing follow-up, applying the recording of cash receipts, controls and procedures for scheduling from the sales divisions, credits and collection division procedure. In general, it would present a correlation of activities of the sales department, credit and collection division, accounting department and treasury department.

The same type of correlation of activities would be included in a review of accounts payable: procedures manuals, purchasing department, treasury activities, discounting, disbursing, accounting, warehousing and traffic. A review of pay rolls would by necessity require an examination of correlated activities performed by other departments which assist in formulating and preparing the pay roll. The usual examination for accuracy and substantiating of the authenticity of a pay-roll check is just one phase of the examination. To complete an internal audit of examination of a pay roll, the following departments' activities in relation to pay roll should be reviewed and/or noted:

1. *Legal department.* Union contracts; details regarding rates, holiday pay, sick leave; working facilities; state and local regulations regarding employment.
2. *Tax department.* Directions from the tax division, ascertaining Federal, state and local taxes applicable to employment; date of filing returns and to whom.
3. *Personnel department.* Requisitions for new employees; completion of individual employment records: applications, references, signature, aptitude and physical examinations, date of hiring, date of discharge, resignation causes or reasons.
4. *Plant protection service.* Employees identification badges; supervision of time clocks, passes, items carried in or out of plant;

employees leaving premises at unusual times; comparison of list with time records.

5. *Industrial engineering division.* Current incentive plans, procedure of operation, method and rate of computing incentive, incentive production records and results of incentive.
6. *Plant operations.* Production reports, number of employees per operational section, foreman's time reports and allocation of expense distribution.
7. *Purchasing department.* Procedures and methods, if employees are allowed to purchase company product from plant, or accommodation purchases for employees authorized by the purchasing department.
8. *Treasury department.* Signing pay-roll checks, safekeeping of checks until ready for distribution, distribution of pay-roll checks, transfer of funds to pay-roll accounts, payment of employment taxes, pay-roll fund bank reconciliation.
9. *Statistical division.* Number of employees currently employed, as opposed to number of employed in previous months or years; the reasons for increase or decrease; other statistical information on turnover of employment, etc.

Constructive in Approach

While reviewing any of these divisions, the auditor might note a situation which would require further examination. He should inform his supervisor of it immediately. If the situation is relative to the pay-roll examinations, the supervisor may extend the examination, or decide to have a review of the department's activities performed at a subsequent examination. Thus a review of one operation may disclose weaknesses in other departments or activities.

The internal auditing division is responsible for the verification of the authenticity and accuracy of accounting records and for a review of operational functions and procedures, thus performing a valuable service to management. This type of internal auditing does not disregard disclosing errors or omissions or defalcations but also discloses weaknesses in procedures and operations and recommends further investigation and correction by responsible personnel. Consequently, investigating, coordinating and advising are the most essential contributions made by internal auditing.

A good internal audit division can be a valuable tool for management by ascertaining:

1. Whether sound business practices and the company's policies are adhered to and properly administered.

2. Whether the procedures and systems adequately furnish complete internal checks, control and protection.
3. Whether the company's assets and revenues are fully protected.
4. Whether costs are consistent with proper controls, and are at a minimum.

To summarize, the internal auditing division is a service to management. The scope of the internal audit division should be to review financial and operational activities. The purpose of the internal auditor is to assure management that the company's functions are performed within designated policy, to assure management, by the verification of accounting, that financial records are reasonably correct and to advise management of any deviations or weaknesses in financial or operational activities.

Recognizing the Effect of Inflation on Financial Reporting

by HANS F. REISS

THE ABUNDANCE of accounting literature on inflation and its effect upon the reported financial figures of business clearly indicates awareness of a disturbing condition, the existence of which has been tolerated for many years in much the same way as the ordinary cold—left unattended until it reaches proportions of major discomfort.

It is not the purpose of this article to illustrate the serious misstatement of net income which results from the failure to cope with the fluctuating purchasing power of the dollar. Rather, this article is directed toward two ends: (1) to point out the relationship of accountants to the problem of changing price levels and (2) to offer, in general terms, a program to combat the problem.

Defining the Problem

Before discussing the relationship of accountants to the problem of fluctuating price levels and its bearing on the income, let us consider first the term, income, and its development in the realm of accounting. This term means different things to different people, and it is quite often modified in order to more distinctly designate the meaning conveyed by the user; so, for instance, it is common to speak of economic income, taxable income and monetary income. In a discussion of this nature, it is necessary to consider the relationship between the economic concept of income and that what may be termed the monetary concept of income. The economic concept of income holds that the substance of business capital must be fully preserved, i.e., allowed for before income is recognized. For purposes of this discussion income determined in the customary manner, by application of generally accepted principles of accounting, will be considered income in the monetary sense. The concept of monetary income was, to a large degree, an outgrowth of economic income.

Initially, the financial reportings of accountants were quite closely associated with the intrinsic value of the assets and liabilities but as the monetary concept of income developed, more and more emphasis was placed upon a common

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denominator—the dollar. Additional impetus to the abandonment of the previously used appraisal method of determining net income was provided by the business community as its primary interest shifted from the assets and liabilities, as reflected on the balance sheet, to the results of operations, as reflected on the income statement.

Inherent in the concept of monetary income is the assumption that the monetary unit remains stable. Such an assumption is not warranted. Conventional financial statements and other accounting reports ignore the substantial fluctuations in the value of the dollars in which the assets and liabilities reported upon are expressed.

Economic vs. Monetary Income

The argument might be presented that the accountant should not concern himself with the economic connotations of the term but rather should limit his interest to the determination of income in the monetary sense. However, since accounting is not an end in itself, its worth must be judged by the usefulness of the information it provides. The truth of the matter is that income and the value of an asset or amount of a liability are economic facts and it is the responsibility of the accountant to express them in monetary terms, as well and as clearly as possible. With the marked change in purchasing power of the dollar which has been experienced, the question should be raised whether or not accountants are providing the information sought by the users of financial statements, and whether more useful information would be provided if the effects of inflation were isolated and disclosed, thus setting forth more clearly the economic achievements of business. Knowledgeable people accept the fact that accounting does not attempt to measure income with absolute precision. However, this is no excuse for accountants to fail to fulfill to the best of their abilities the needs of the readers of financial reports.

Depreciation Based on Replacement Cost

One of the greatest controversial areas in the over-all question of the effects of inflation is that concerning the calculation of depreciation on the basis of replacement cost. The point has been maintained that, under generally accepted accounting principles, grossly inadequate depreciation is charged against operations and, as a result, the assets of business are being jeopardized because the companies are not able to provide, through depreciation, sufficient dollars at their deflated value to replace these assets. However, some accountants, just as a side-issue, find themselves defending the historical dollar concept simply be-

cause they do not accept the contention that the primary purpose of depreciation is to provide a fund with which to replace the fixed assets of a business.

Depreciation based on replacement cost falls short of providing a satisfactory solution to offsetting the effects of a dollar fluctuating in purchasing power. There are several reasons to support this conclusion. First, it would provide adjustment in only one area. A proper solution should acknowledge that inflation or deflation affects all the accounts, and provide for adjustment on such a basis. Secondly, such a procedure can be criticized because of the difficulties involved in the calculation of depreciation based on replacement costs. It is apparent that depreciation would lose a great deal of its objectivity.

To a certain extent, depreciation is already somewhat subjective, due to the estimates which must necessarily be made in regard to salvage value and useful lives. Our problems will be multiplied if we must also consider the additional estimates which are embodied in determining depreciation based on replacement cost. If depreciation is to be so calculated, then, in addition to estimating the useful life of an asset (the year of replacement), it will be necessary to estimate the value of the dollar in the year of replacement. Moreover, the effects of technological improvements would also have to be taken into consideration.

The Controversy Over Historical Cost

Historically one of the basic accounting concepts has been that cost is the proper basis of accounting for assets and expenses. An argument which has often been introduced in discussion is that any price-level adjustment is a departure from historical cost, and, therefore, not prudent. In this regard a distinction must be made between adjustments made on the basis of a general price-index and those made on the basis of a specialized or industry price-index, since the latter is a departure from historic cost which is not the case with the adjustment based on information supplied by a general price-index, such as that of the Bureau of Labor Statistics Index of Consumers' Prices. The adjusted figures merely represent the restatement in terms of dollars, possessing the current year's purchasing power, of costs incurred in an earlier period. Such adjustment should not be considered a change in the basis of valuation but, rather, a change in the terms in which such costs are stated. Thus the price-level adjustment affects the figures in much the same way as does a foreign exchange adjustment.

Selection of the Price Index

Acknowledging the fact that the change in purchasing power of the dollar is causing a misstatement of financial reportings and accepting the historical

cost basis as preferable, it may be concluded that figures presented in the customary financial reports today should be adjusted by the use of a general price-index. Even though the selection of the price-index to be used is limited to those measuring general purchasing power, there is still quite a list of indices from which to choose. At the present time, the Bureau of Labor Statistics Index of Consumers' Prices seems to be the best answer to the problem. The index, published on a monthly basis, is soundly constructed and readily available.

Shortcomings of Using Price Indices in Adjusting the Figures

The point has been raised by some accountants that price indices, being necessarily based upon averages and sampling techniques and influenced by phenomena other than inflationary or deflationary pressures, will, if used for adjustment purposes, introduce further misstatements into the accounts. However, we should not discount the contribution which can be made to reporting of accounting results because of the relatively minor inherent shortcomings the index numbers might possess. We should also consider that because of the ever expanding use of indices and because of the important conclusions being drawn from them, every effort will be made to incorporate into them all factors resulting from improvements in reporting and sampling techniques.

The difficulty of calculating the conversion to uniform dollars has also been cited as a major roadblock in recognizing and isolating the effects of changing price levels. It is true that it does result in additional work not performed in the past but the procedure is not one of overwhelming difficulty. This calculation is quite similar to converting to dollars assets, liabilities and transactions stated in terms of a foreign currency, a practice which is fairly common and well known.

Selection of a Base Period

In order to reflect the various items in monetary units of uniform purchasing power, it is necessary to select the dollar of a particular date or period as the standard or base dollar into which all dollars will be converted. Several possibilities present themselves in the matter of selecting this base period.

Consideration could be given to using the first year the company did business as the base year. In each subsequent year the current figures would be converted and stated in terms of dollars of the first year the company had operations. Such a procedure has a fundamental psychological shortcoming, however, in that it is natural for readers to interpret the dollars as presented in the state-

ments in terms of possessing the purchasing power of the current year's dollars rather than that of the base period established in prior years. For this reason, it is generally considered preferable to convert dollars of past periods to current year's dollars.

What the Adjustment Accomplishes

At this point it would be advantageous to summarize the accomplishments of utilizing a general price-index and converting to current period dollars. To begin with, it is important to recognize what the adjusting of figures will not do. Assuming a cost basis prior to conversion, the adjustment will not change this basis. The adjusted figures will not, except by coincidence, reflect estimated replacement costs of the assets. What the adjustment will have accomplished is to state the balances and transactions of the prior year in terms of the purchasing value of the current year's dollar.

The Ultimate Goal

Because the financial reports are intended to disclose economic facts, the ideal situation would be to simply present a report in which the effects of changing purchasing power have been eliminated. Successful accomplishment of such an objective embraces a more difficult problem than making the mathematical computations necessary to adjust the historical figures. The most formidable and important task will be that of educating and conditioning the users of accounting data to the fact that a fundamental change has taken place in the presentation of the items appearing in the report.

A basic change such as is being recommended here cannot be expected to be accepted and understood immediately. Many questions will develop because of the widespread and drastic effects resulting from such a change in reporting policies. For these reasons and because not all firms would make the change at the same time, it has been suggested that, for the present, financial statements should continue to be prepared on the customary monetary basis but supplemented by footnotes or schedules in which the effects of changes in the dollar's purchasing power could be expressed.

It should be recognized that disclosure by supplemental means is only an interim, conditioning procedure and is not the ultimate goal we are seeking. If fluctuation of the intrinsic value of the dollar continues to be a problem (and there is no reason to believe it will not), accountants should strive to provide

financial statements and reports in which the results of operations are isolated from the effects of changes in the purchasing value of the dollar.

Recommended Action

Although accountants have been very prolific over the last two decades in their writings concerning the consequences of inflation in the financial statements, few companies have taken the initiative and are actually disseminating financial information which shows the effects of changes in the purchasing value of the dollar. In July 1959, the research department of the American Institute of Certified Public Accountants conducted a survey covering 669 corporate executives and educators which solicited their opinion as to the advisability of disclosing the effects of price-level changes upon depreciation of plant and equipment. It was concluded, as a result of this survey, that the executives and educators believed that disclosure should be made as to the effect of inflation on the financial statements. In fact, a goodly number replying were of the opinion that disclosure of the amount of "current dollar" cost of depreciation should be a mandatory requirement.[1] From this we may conclude that those in the business field who are not accountants share the alarm of the accountants over this misstatement of financial information. Thus we find ourselves confronted with the unusual situation in which almost everyone is in agreement as to the fact that a problem exists but only a few are willing to assert themselves and attach a dollar and cents price tag to the problem.

The question should be raised, therefore, as to why practicing accountants have failed to face the problem. Could it be that they are afraid of the results of the additional work involved? Perhaps they have a feeling that adequate means are not available to adjust the figures, or could it be that they are just reluctant to change? Probably all of the preceding points enter into the problem to some extent. The question then is are they sufficiently valid to avoid tackling the problem? The answer must be negative.

We must consider, therefore, what should be done. It should be clear that it is up to accountants to take the initiative. We must not find ourselves prodded into action because the laity is casting aspersions upon and discounting the figures and reports the accounting community is providing. Accounting as a profession must meet the challenge of providing financial data which will be of the most benefit to the users.

What specific action should be taken? I believe it is incumbent upon accountants to do the following:

[1] *Journal of Accountancy*, April, 1958.

1. If they have not already done so, familarize themselves with the problem of inflation and financial reporting. Sufficient case studies have been prepared and numerous articles have been written so that the problem and possible solutions are well defined.
2. Agree upon the use of the Bureau of Labor Statistics Index of Consumers' Prices in computing the adjustment.
3. Corporate accounting staffs with the aid of their public accountants should determine the materiality of the effects of changing price-levels on the accounts of the companies with which they are associated. In this regard, it should be pointed out that although for some companies, because of their financial make up, price-level changes may not significantly affect the calculation of income for a particular year, the procedure of adjustment cannot be considered unnecessary since presentation of prior years' figures will probably lack comparability of purchasing power.
4. Begin the practice of augmenting the customary financial statements with information concerning the effect of the changing price levels.
5. Emphasize the information provided in the supplemental schedules or footnotes so that the users of the statements will become aware of this new concept and will not be confused by or distrustful of it.
6. Continue the necessary research and discussion, so that ultimately the framework of accounting will be expanded and will allow the effects of a changing price level to be compensated for in the basic financial statements.

In conclusion let me re-emphasize some points made in the earlier paragraphs of this article. Created and developed to serve various elements of society, accounting has been adapting itself over the many years to the changing requirements of business. If the profession is to continue to be responsive to the needs of the users of financial statements, recognition must be give to the effects of a fluctuating monetary unit in these statements.

Some Thoughts on Accounting Reports

by J. G. UNDERWOOD*

ALL ACCOUNTANTS agree that accounting reports are a tool for communicating financial information to management. Most accountants disagree on the amount, extent and type of reports that should be prepared and, also, to whom they should be issued. There is no pat, standard, best, one and only, reporting procedure. It is a living thing. It changes with the times, it changes with the business, with personalities, yet, it must be controlled and administered.

Reports which emanate from the accounting operation can be generally separated into two groups:

1. Basic reports, which are generated by the accounting system itself in recording the physical transactions of the business (such as sales, receiving money, paying bills) or which are necessary because of legal or tax requirements.

2. Service reports, which are in addition to, over, above and beyond the basic data the minimum accounting system would normally reflect.

The first group of reports is really an integral part of the accounting system. Here, accountants are concerned primarily with problems of method of report presentation.

It is with respect to the second group of reports that the additional problems of frequency of preparation and necessity accrue. If we believe that we have an efficient accounting operation yielding the basic reports economically, where the service reports are controlled and top management seems satisfied, maybe we should be satisfied too.

On the other hand, reports from the accounting operation may not be sufficient for properly guiding the course of the company's activity. Many phases of the business operation contribute to profits and justify reporting in some form. For example, research development, sales, customer relations, engineering and distribution, all play a part toward making a success of the business. How do we know whether each segment is reported and controlled in proportion to its contribution to profits? The author believes that there should be an over-all blueprint which would indicate, from an over-all company basis, just what the reports and systems should contain to properly assist the business management.

Any successful company has prospered not because it had mechanized equipment, nor because it did some clerical operation at half the cost, or had the usual run of reports, but because, over the years, the management was able to make the proper decisions regarding the company. Somewhere, key factors in the business which were reported to them enabled them to operate it profitably. Without knowledge of these key factors, the most elaborate reporting structure is of little value. Reports must facilitate the exercise of human judgment, not be a substitute for it. The multitude of facts and figures must be simplified so that men can use their own minds for the risks of business. The real test is whether the operating people understand and use the product of the reporting system in their work of governing the processes of the business.

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Accounting-Related Features in Business Mergers

by JACK E. STEVENS

PAST DECADES have witnessed an increasing number of business combinations, over 4,000 in the past ten years alone, from a rate of 300 a year in 1950 to more than 500 a year at the present time. The combination of business enterprises is rapidly becoming the rule rather than the exception.

Such combinations have often been achieved through procedures that have resulted in the fusion of different companies into larger single units. These fusions have been accomplished through purchase or pooling of interests. Combinations have also been effected through stock ownership or interlocking directorates. With such a domination of one company over the affairs of another, unified and integrated operations have been achieved in spite of the retention of separate corporate identities by each company.

The trend toward combination has been stimulated by advantages such as the economies and efficiencies that can be effected in management and in production and marketing, increased control over the market and reduction of competition, improved position with respect to sources of raw material supply, and improved position in financing capital requirements. While the ultimate goal of the individual combination has in most cases been greater earnings, operation on a larger scale has frequently benefited the consumer group as well. Lower costs of large-scale operation and specialization have resulted in lower sales prices. Standardization of product and product parts has brought further advantages to the consumer.

Purchase and Pooling of Interests

The two methods of business combination with which accounting is most directly concerned are purchase and pooling of interests. A purchase is a business combination of two or more corporations in which an important part of the ownership interests in the acquired corporation or corporations is transferred. In contrast, in a pooling of interests the holders of the ownership interests in the constituent corporations share the ownership of a single corporation which

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owns the assets and businesses of the constituent corporations. Such corporation may be one of the constituent corporations or it may be a new corporation. However, the continuance in existence of one or more of the constituent corporations in a subsidiary relationship to the new corporation does not prevent the combination from being a pooling of interests if no significant minority interest remains outstanding.

The distinction between a purchase and a pooling of interests is important in that the accounting treatment of the assets also differs. If the combination is a purchase, assets are carried on the purchaser's books at cost; if it is a pooling of interests, assets of the predecessor companies are carried on the books of the new unit at the predecessor companies' book values, assuming these values have been arrived at through generally accepted accounting principles uniformly applied. However, regardless of whether the combination is a purchase or a pooling of interests, the initial problem confronting the accountant is the same—that of determining the relative values of the common stock of the constituent corporations. Basically, there are two standards used: asset value and earning power. Some of the factors that must also be considered in determining these values are earning records, dividends, market values and net book values.

Relative Values—Assets and Earnings

Where the corporations are listed on a stock exchange and their securities are actively traded, the problem is usually fairly simple. It is reasonably certain that the market values of the stock reflect earning records, dividend policies, and asset values. This is based on the theory that the investing public have already considered the respective values of the corporations and have established their relationship marketwise. However, if not all the corporations are listed, the problem becomes more difficult. Stockholders of a corporation having high and rapidly growing earnings in relation to the book value of its assets will naturally expect to receive more than book value. Conversely, stockholders of a corporation with relatively high book value but with low earnings will want to trade on the basis of net assets. There are various ways of adjusting differences in book values and earning-power values. A few examples will show some of the ways in which this can be done.

Consider the problem of assigning equities in a new corporation to stockholders of contributing corporations in a pooling of interests. For illustrative purposes, the pooling of interests will be in the form of a consolidation, i.e., the net assets of the constituent corporations are transferred to a new

corporation organized for that purpose. Securities of the new corporation are issued to stockholders of the constituent corporations in exchange for the stock they held in those corporations.

As stated, the chief considerations in assigning equities in the enlarged unit to former ownership groups are (1) relative net asset contributions and (2) relative earning power contributions. Both are material in reaching an agreement, although the final settlement may be influenced to a great extent by the relative bargaining power of the constituents.

The determination of net asset contributions requires special analysis of the balance sheets of the constituent companies. More often than not, the balance sheets will have to be recast in order to achieve a uniform and comparable accounting for all companies. The following practices, in particular, warrant attention and appropriate modification to achieve statement comparability: valuation methods applied to securities, allowances relating to receivables, cost determination and valuation procedures for inventories, depreciation methods, amortization policies, and policies applied to recognition of deferrals and accruals. While, under ordinary circumstances, alternative procedures in these areas may be equally acceptable, the special purpose for which the statements are to be used requires the selection of particular procedures or policies and their uniform application. An accounting uniformity having been obtained, further inquiry into the adequacy of this data as a basis for measurement of net asset contributions must be made. Asset book values summarize historical costs. However, assets must not be viewed in terms of historical cost, but in terms of their present values. The services of an independent appraiser may be required to help determine these values.

The determination of earning power contributions requires detailed analysis of past income statements. These statements may also require recasting in order to achieve a full and comparable accounting. The following items require particular attention: measurements of cost of goods manufactured and sold (including inventory methods employed in such measurements), charges for depreciation and amortization, bad debt recognition, charges for executive salaries, and corporate financing charges. The trend in the past few years has been toward more emphasis on the earning power contribution as compared with the net asset contribution of each party to a consolidation. It is generally recognized that an asset is only worth what it can earn. For this reason, careful and detailed analysis of the past earnings of the constituent companies and the projection of the earning power forward to the new company is of special importance.

After analyzing the financial statements to determine both net asset and

earning power contributions, the problem remaining is how to distribute equities in the new company to stockholders of the contributing companies.

Distribution of Equities

It may be possible for the new company to issue only one class of securities to contributing companies. However, in some instances it may be necessary to issue two or more classes of securities in order to properly recognize relative contributions.

When one class of stock is to be issued, it is normally issued to participating companies in relation to net assets contributed to the new unit. Earnings contributions of the individual companies that are considered above normal may be used as a basis for the calculation of goodwill. Goodwill is then added to the other net assets in measuring the full contributions of the individual units. To illustrate, assume that stockholders of Companies A, B and C agree to consolidate and form Company D. Net assets at adjusted values and average earnings of the past five years are as follows:

	Total	*A*	*B*	*C*
Net assets	$500,000	$100,000	$150,000	$250,000
% of contribution to total assets		20%	30%	50%
Average annual earnings	$ 50,000	$ 15,000	$ 15,000	$ 20,000
% of contribution to total earnings		30%	30%	40%

If Company D issued a single class of stock in proportion to net assets contributed, stockholders of Companies A, B and C will receive stock in the ratio of 20:30:50 respectively. While this will result in an equitable distribution of net assets of Company D, the stockholders of Company C will gain on the distribution of earnings of Company D at the expense of the stockholders of Company A. If stock is issued in the ratio of earnings contributions, i.e. 30:30:40, earnings of Company D will then be distributed to the stockholders of Companies A, B, and C in their original earnings ratio but stockholders of Company C will suffer a shrinkage in their original interest in assets and Company A stockholders will gain. In either case, the stockholders of Company B will receive the same amount of interest in both the net assets and earnings of Company D, since Company B's percentages of net asset and earnings contributions are equal.

Recognition of Goodwill

To avoid the inequities resulting from distribution of a single class of stock

in either the net asset ratio or earnings ratio, the parties may agree to recognition of net asset values as shown above plus goodwill calculated on the above-normal earnings of the constituent companies. A normal return for this industry will be assumed to be 6 percent. Above-normal earnings will be capitalized at the rate of 20 percent. This results in the following relative contributions:

	Total	*A*	*B*	*C*
Goodwill:				
Average annual earnings	$ 50,000	$ 15,000	$ 15,000	$ 20,000
Normal return on assets (6%)	30,000	6,000	9,000	15,000
Excess annual earnings	$ 20,000	$ 9,000	$ 6,000	$ 5,000
Excess annual earnings capitalized at 20%	$100,000	$ 45,000	$ 30,000	$ 25,000
Net assets other than goodwill	500,000	100,000	150,000	250,000
Total contributions	$600,000	$145,000	$180,000	$275,000
Percent of contribution to total contribution		24 1/6%	30%	45 5/6%

When relative earnings contributions differ from relative net asset contributions, original relationships in both earnings and net asset contributions by individual companies cannot be maintained when only one class of stock is issued by the new company. It can be seen from the preceding example, however, that effect is given to both earnings and net asset contributions for Companies A and C, even though their original relationships are not maintained.

Utilization of Two Classes of Stock

If original relationships in both net asset and earnings contributions are to be maintained, it is necessary to issue two or more classes of stock. To accomplish this, the following procedures are applied:

1. Earnings of the constituent companies are capitalized at a rate that must not exceed the earnings rate of any of those companies. This procedure determines the total stock to be issued to stockholders of the contributing companies. As a practical matter, earnings of the companies will be capitalized at a rate below the lowest earnings rate of any of the companies. If the earnings are capitalized at the same rate as the lowest earnings rate of any of the companies, the stockholders of the company with that rate will not receive any common stock in the distribution of equities in the new company (see 2.

and 3. below). There are good reasons why they might object to this. They would have no voting rights or any interest in the growth potential of the new company.

2. Preferred stock is distributed in proportion to the net assets contributed by the several parties. The dividend rate on preferred should not exceed the rate used in capitalizing profits. The preferred stock should be fully participating with common. (To maintain the original relationships in earnings distributions at any level of earnings, it would be necessary for the preferred stock to be preferred only as to assets and have no preference as to dividends but simply participate fully with common stock. However, parties to the consolidation might object to the issuance of this unusual type of preferred stock.)

3. The amount of common stock to be issued to stockholders of each member company is based upon each company's respective total (as calculated in 1.) less the amount it receives in preferred stock (following the procedure in 2.)

To illustrate the foregoing procedures, assume again contributions as previously indicated:

	Total	*A*	*B*	*C*
Net assets	$500,000	$100,000	$150,000	$250,000
Average annual earnings	50,000	15,000	15,000	20,000
Earnings rate on net assets	10%	15%	10%	8%

Assume that it has been agreed to capitalize earnings at 6 percent. This would result in the following:

	Total	*A*	*B*	*C*
Total stock to be issued (average earnings ÷ .06)	$833,333	$250,000	$250,000	$333,333
5% preferred stock issued	500,000	100,000	150,000	250,000
Common stock issued	$333,333	$150,000	$100,000	$ 83,333

The preferred stock issued to stockholders of the contributing companies preserves the original relationship with respect to claims on the net assets of Company D. The total stock issued to these stockholders, preferred and common, results in a distribution of earnings in the original ratio of earnings contributions, so long as earnings distributions of the new unit are at least 5 percent on common as well as preferred stock. In this example, Company D would have to distribute earnings of at least $41,666 (5 percent of $833,333) in order to maintain the original ratio of earnings 30:30:40, for stockholders of Companies A, B and C, respectively.

Conclusion

There are various refinements applied to the use of both preferred and common stock in the distribution of equities. A recent example is the merger of two moderately large, closely held corporations. Corporation A had a ratio of net assets to current earnings of 9:2; Corporation B had a ratio of net assets to current earnings of 8:1. Obviously, a division of common stock solely on the basis of earnings would have resulted in a proportion for Corporation B considerably below its book value. The problem was solved by giving stockholders of Corporation B convertible preferred stock in addition to common stock in the surviving corporation, the theory being that, as the assets contributed by Corporation B generated earnings, there would be an increase in value of the common stock, thus making a conversion of the preferred into common more attractive.

The area of business combination is one in which the accountant plays an invaluable role. His success depends to a great extent on his imagination and ingenuity as well as his technical ability. The procedures and techniques presented here are bases to work from, not ends to work toward. Each combination has its own peculiar problems to be solved, and the plan of combination must be adapted to the solving of these problems. While the decision to combine originates with management, its development to maturity is largely the accountant's responsibility. Although the final result of the combination will probably be decided around a bargaining table, the tools the accountant supplies the bargainers have a large influence on its result.

Speak the Language

by CARL M. KOONTZ*

ACCOUNTANTS, in all phases of our work, have gradually come to the realization that good accounting is more than balancing the books and publishing a financial statement. A good cost control program requires taking detailed cost analyses to the people who are spending the money. These people include all levels of management, from unit foreman to

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the president of the company. So the effective accountant of today by necessity must be an expert in the art of communication. Although we accountants have many times accused doctors, lawyers, engineers and other professional people of deliberately using technical terms and even foreign languages to impress their clients, it is also our common mistake to assume that everyone completely understands all of our special accounting terms. We frequently toss around such terms as "lifo," "fifo," amort., unabsorbed burden, and hundreds of others, without bothering to find out whether the fellow on the receiving end has the slightest idea of what we are trying to tell him.

We are quick to notice when a metallurgist or an electronics expert talks "over our heads." However, many times each week, we in accounting are guilty of the same error—poor communication. One of the earmarks of a truly educated man is the ability to express complicated information in simple terms. Much of the value of our work can be lost if we are unable to pass the necessary information along in understandable terms. The message must get through before effective action can be taken.

Many large companies, in recent years, have recognized the need to put financial data into simple terms. Annual reports cut up the "pie," showing the size of the slice for each type of expense. We have condensed the big words of a financial statement to this simple formula—what we have minus what we owe equals our worth.

While it is true that we are simplifying certain of our reports to shareholders and others, there is much to be done along this line in our everyday work. How many times have we found it necessary to explain a report which we thought was perfectly clear? How many times has the message failed to get through? Do people sometimes get the wrong idea from our letters, reports or conversations? Those of us who have made accounting our career may find the answers to the above questions somewhat embarrassing.

People most effective in communicating their ideas and information to others always speak the language familiar to the listener. The next time you make a report, either oral or written, why not try to use simple one-syllable words? Save your big words for other accountants. Your reports will mean more to everyone concerned. Both you and your company will benefit.

When talking to the other fellow, speak his language—not your own.

Financial Statements as Elementary Business Models

by PHILIP L. BLUMENTHAL, JR.

DURING THE YEARS since World War II, mathematicians and operations research workers have been actively engaged in developing mathematical models of various types of industrial situations, such as the transportation model, the waiting line model, the inventory model, and the machine loading model. Most of these require specialized training or reading before they can be constructed or used by executives.

For the company whose available talent is less sophisticated in modern scientific methods, simplified operations statements and balance sheets can well serve as mathematical models for certain planning and control purposes. The reader who doubts this is reminded of those days, not so remote, when a periodic profit and loss statement and balance sheet were all the quantitative information the small businessman ever had about his business. It would be pleasant to state that this era has passed. However, it should not be difficult to locate certain segments of our economy where the "boss" would consider himself indeed fortunate to receive these statements on a regular monthly basis.

It is to the smaller company, without an array of highly trained statistical or research personnel, that this paper is addressed. One of the basic goals of operations research is optimization of a given situation in which resources are limited. In simpler terms, this is known as, "Making the most of what you've got." The two resources most severely limited in the smaller company are capital, which appears in the balance sheet, and talent, which does not. How, then, can the smaller company use its resources in such a manner as to optimize a given situation? Or, in simpler terms, how can we increase our net income?

Many books and articles have been written on sales management, marketing, production control, manufacturing management, time and motion study, expense control, budgeting, forecasting, financial management and other fertile areas for increasing income. The specifics of these areas have been dealt with competently elsewhere, and will not be reviewed here. The reader whose company is in need of further information on these subjects is advised to obtain it from his library, bookseller or from files of the *N. A. A. Bulletin*.

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Constructing the Model

The model of the company, we have said, can be derived from its operations statement and balance sheet. These statements probably contain far more than the required amount of detail for planning, and must be "boiled down" for ease in working.

Dr. Andrew Vazsonyi[1] describes a mathematical model of the business problem as "a system of equations that describes a business problem." Even the accountant whose mathematical training stopped at elementary algebra will recognize that the business balance sheet equation, $A = L + E$, fits this description, where A = assets, L = liabilities, E = capital, or equity.

In the same manner, the operations statement, or $S - (C + X + T + D) = I$, fits the description where

S = Sales (net).
C = Cost of goods sold.
X = Expenses, selling, general and administrative, net of other income and expense.
T = Federal income taxes.
D = Dividend requirement.
I = Net income carried to equity.

The link between the two statements might be described as $E_1 + I = E_2$, where

E_1 = Equity at the beginning of the period,
E_2 = Equity at the end of the period.

The problem itself may vary with conditions but will nearly always take the ultimate form of attempting to maximize I (or D). This is usually accomplished by increasing S without undue increases in C, X, and T, or by reducing C, X, and T without adverse effects on S.

So much for the mathematical notation. The reader who is experienced in setting up models in formal mathematical terms is advised to stop here—the remainder of this paper is devoted to a description of how the accountant or executive of a small company can accomplish, in a less refined but still practical manner, some similar planning and decision-making operations on the data available to him. Titles of other articles helpful in this direction are given below.[2] For the rest of the paper, we shall use the term "model" in this sense

[1] Scientific Programming in Business and Industry, John Wiley & Sons, 1958.

[2] C. W. Bastable, "Business Games, Models, and Accounting," *Journal of Accountancy*, March 1960.

A. E. Witte, "The Income Statement as a Management Tool," *Journal of Accountancy*, October 1959.

R. Mattesich, "Mathematical Models in Business Accounting," *Accounting Review*, July 1958.

A. Vazsonyi, "Statistical Techniques for Financial Planning and Forecasting," *The Controller*, May 1957.

C. B. Allen, "Introduction to Model Building on Account Data," *N.A.(C.)A. Bulletin*, June 1955.

to mean: A condensed, rounded, simplified set of operations statements and balance sheets giving an overall picture of the business through several time periods. It is important to note that the time periods extend *both ways from "now"*—back and ahead.

Key words in this approach are (1) condensed and (2) rounded. In constructing the model, the accountant should *condense* the mass of data to a few significant figures. The typical smaller company has some 50 to 100 accounts in its general ledger. For purposes of the planning model, these can be reduced into perhaps a dozen or less general categories. It is desirable to group like items into as few significant categories as possible, showing separate classes only where the shift between them is important for planning purposes. For instance, the condensed captions in the income statement of the typical manufacturing company might be:

Sales, net of all discounts and allowances
Cost of goods sold:
    Material
    Labor
    Factory burden
        Total
Gross profit
Selling expense
General and administrative expense
    Net operating income
Other income
Other expense
    Net income before Federal taxes
    Federal income taxes
    Dividend requirements
    Net income after taxes

Similarly, the balance sheet captions might look like this:

Current assets:
    Cash
    Receivables, net
    Inventories
    Other current assets
        Total current assets
Fixed assets, net of depreciation, total
Other assets
        Total assets
Current liabilities:
    Current payables and accruals, total

Current portion of bank debt
Total current liabilities

Long-term liabilities, total

Total liabilities

Equity (unless changes in capital structure are being considered, one total should suffice)

(Note the report form—the luxury of more than one column just cannot be afforded where the purpose is to show comparative balance sheets over a two-way span of time, forward and backward.)

Of course, more categories can be used if needed, but the cardinal rule is "Keep it simplified."

Many accountants are used to treating sales discounts as "other expense." That is quite proper for financial reporting, but for use in a general model it is strongly suggested that all discounts be deducted directly from sales. The reason is, of course, that ratios of material, labor and burden to sales income are more safely calculated on the net sales dollar than the gross dollar.

While the same reasoning might be applied to purchase discounts, it is considered safer and often more convenient to leave them in the "other income" section, so that "cost of goods sold" includes materials at gross prices. It may be noted, also, that cash discount allowed on sales tends to be much greater than that earned on purchases since sales will be 2.5 times purchases if material cost is 40 percent, and 1.33 times if it is 75 percent.

In general, it is desirable to net out as many reverse or offsetting accounts as possible, such as "provision for doubtful accounts" and "accumulated depreciation."

Considering relative size, items which in good accounting theory merit individual treatment for control purposes, may well be combined for planning purposes with entirely different items. For instance, the company with $94,267.23 in net fixed assets and $475 in air line deposits might well use $94,742.23 in its planning model.

Rounding off is the next point to consider. Instead of $94,742.23, why not round this off, not to $95,000, but to 95? While this may seem perfectly obvious to some readers, it will possibly shock others. Yet, if tomorrow's bank balance or next year's sales cannot be predicted to the nearest dollar, what is the value for planning purposes of using $94,742.23 instead of 95? It is not the intent here to discuss the merits or deficiencies of "centsless accounting." It is rather to emphasize the need, in planning as contrasted with control, of the utmost streamlining in the handling of numbers which are sometimes uncertain

and nearly always in a state of change. "Nearest thousand" is recommended for those companies with annual sales between $100 thousand and $10 million; it focuses executive attention only on the significant figures, reduces the space needed in the planning model, makes the model easier to manipulate, flexibility being one of the keys to a successful model, and decreases the *need* for manipulation—only significant changes need be considered in working with the models, small adjustments can be absorbed in the "slack." (Note that when the scientists speak of "manipulating" the model, it is quite a respectable and worthwhile process. Manipulation in this sense carries none of the unpleasant connotations of concealing defalcation, chicanery or tax fraud as it does when used with reference to altering basic records. The term, rather, implies either (1) adjusting the model to reality or (2) trying out various courses of action before deciding on one.)

Physical Format

Details of recommended physical format have purposely been left somewhat vague, because of varying conditions in different companies. Basically, what is envisioned is a worksheet on a good, tough grade of columnar paper, that will take frequent erasures. It might be on plastic or in the form of a chalk board, or a wall board with replaceable gummed stickers, magnetic numbers or other movable numbers or counters. A number of these are available commercially. The wood shop of almost any plant might construct one. (Incidentally, one of the big disadvantages of wall display is the security problem —being seen by unwanted persons. The wall display will be practicable only where there is a reasonable amount of privacy, for having to "put up and take down" frequently would, in all likelihood, defeat the purpose of the model. In some instances, the model might assume graphic form, although again, this is harder to keep current.) The main requirement is flexibility; it should be as easily changeable as a scoreboard for athletic contests, and for the same reason—the score keeps changing.

As to appropriate column headings, this, too, will vary. The main requirement is "both sides of *now*." A wholesale grocer might want weekly comparisons, while many manufacturers would feel that quarterly comparisons are sufficient to keep the big picture. In a highly seasonal business, comparative models might well show a succession of January captions for several years across the one sheet, February captions on another, and so on. Similarly, whether "this period only" or "year to date" is better, or whether both are needed, is best left to the company itself. Again, however, the more models made, the simpler each should be, or the project is likely to collapse under its own weight.

Maintaining the Model

Dr. Norbert Wiener[3] describes feedback as "The control of a machine on the basis of its *actual* performance rather than its *expected* performance." The same principle holds true for the business entity. Having planned a certain mode of operations, it is highly desirable to compare results with that plan. We must not only feed back actual operating results into the model, but we must also update the plan, based on actual current performance. Here again, the model, being condensed and rounded, is more flexible and easier to adjust.

As to physical means of updating the information projected in the model, a little ingenuity in the use of columnar paper, transparent plastic grease-penciled overlays, and photocopy machines, should yield a set of model statements which are easily and quickly updated as current information comes in.

As to techniques of updating, the first requirement, of course, is to adjust the historical data. We must also, however, recognize that history has produced certain trends, ratios and rates that affect the projected data. For instance, if it appears that a shift in product mix has changed the ratio of direct labor to sales from 21 percent to 24 percent, this should be reflected in the data projected into the future. If it looks as if sales for the rest of the year are shaping up quite differently from the original expectations, then a revision of nearly all other factors in the operations projection is indicated. There is some interlocking effect on the projected balance sheet; since inventories can probably be reduced, the amount tied up in receivables should be significantly smaller, and so on. Here is where the simplicity in approach starts to pay off.

Using the Model

Now that we have a model or picture of the company, what shall we do with it? How shall we use it? Here are several possibilities:

Study it. The small company president may never have really studied the relationships between the big totals of the company because they have been obscured by the mass of figures on the conventional statements. Such questions as "Why are the receivables two-thirds as much as the inventories?" or "Do we really have that much tied up in fixed assets?" emerge when looking at the condensed picture. Because the quantity of figures has been greatly reduced, it is even suggested that some of those remaining be memorized.

Plan with it. The needs for forward planning, budgeting and financial forecasting have been brought out at length by a number of authors. Many budgetary

[3] *The Human Use of Human Beings,* Doubleday and Company, 1954.

procedures are so detailed that small companies can easily take this attitude: "Maybe someday we can afford a budget." However, the models of operating statement and balance sheet provide a rudimentary but effective tool for the president, the treasurer, the controller, the accountant, or the bookkeeper of a small company to plan future operations and financing over both long-range and short-range planning periods.

Many larger companies and some Government agencies do their forward planning on several levels, such as a ten-year tentative outline plan to provide long-term goals and objectives, a more detailed three or five-year projection, and the annual budgets for the current and following years. A small company can follow the same reasoning, on a less detailed basis. Here are a few typical planning questions that can be answered more easily by means of a simple model:

1. What would be the effect on income of a 10-cent an hour average factory wage rise on next year's operations?
2. If we could reduce our average collection period from 50 days to 38 days, how would that affect our balance sheet next June?
3. Is our inventory level too high for our volume? How much would we have to "chop out" of inventory to have only enough on hand for 3 months' sales?
4. How much bank financing should we need next season?
5. At our present rate of growth, what will we look like in 1970?

It is submitted that in its preoccupation with operations planning, a small company can easily overlook the need for balance sheet planning. Manipulation of a simple model can aid in establishing better balance sheet ratios.

Use it as a training aid. Interdepartmental relationships can often be clarified when the whole company picture is presented to department heads in a simple, easy-to-follow manner. The model of past, present and future broad patterns is considered a valuable training aid in this respect. It can help orient personnel toward company goals rather than solely toward departmental goals.

Relationship to the budget program. Rather than proposing a good model as a substitute for a good budget, it might better be regarded as an interim measure—"first aid" till the budget comes. Some smaller companies, however, lack the time and talent to maintain a full-scale budget program. The model, with its ease of revision, may be the closest approach to a budget that the smaller company has. If a program of budgetary control does exist, so much the better. After the budget system is installed, the model has its place as a briefing tool for executives and as a discussion point for interdepartmental planning meetings.

Detailed schedules of factory expense, selling expense, and general and administrative expense, as well as analyses of sales and inventories by major product lines, are all desirable and often necessary as sub-models for more detailed planning, but their construction and use should not be permitted to over-shadow the "big picture" as carried in the basic statements. The model, then, may be regarded as a tool for explaining or revising the budget in those companies that have instituted formal budgetary control.

We all recognize that accounting data in a real business situation does not as clearly reflect cause and effect as does a laboratory experiment under controlled conditions. Time lag, human factors and random events all tend to produce imperfect correlation between cause and effect. While it is clear that more advertising expenditures should produce more sales, or that more cost accounting should result in lowered costs, the unanswered questions are "When" and "How much." In the areas where top-level subjective judgment must substitute for objective computation, the model is of considerable help.

Most Serviceable to Smaller Companies

The considerations which have been advanced are by no means an indictment of the conventional financial statements, analyzing as these do the major items into components and detailing everything to the last penny. The statements have their purpose and use. The foregoing pages are rather a plea for the greater *use* of data in these statements by management, in looking ahead and in decision making.

It is re-emphasized that none of the foregoing represents any new or original technique. Many readers will recognize the substance of this article as "comparative statements" or "financial forecasting" or "internal reporting" under a slightly different name. None of it is of much help to the company with a sophisticated system of reports, or to one with adequate personnel for furnishing any data desired by management. It merely describes a means by which the small company, hard pressed for time, can "make do" in formalizing its operational planning, until it graduates to the next phase of scientific management.

The Effect of Electronic Data Processing on Auditing

by FRANK J. CURKA

THE INSTALLATION of an electronic data processing system for a business operation brings with it special audit problems which do not exist with the more conventional accounting systems. Prospective users, equipment manufacturers, and auditors have all been concerned about the problems which may arise from the use of E.D.P. equipment because of the absence of visible records, the absence of a method for retracing computations, and the need for an "audit trail" back to original documents. Equipments such as the I.B.M. 700 series and the Univac I and II exclude tabulating card systems which require frequent human intervention and electronic computers which are not part of an integrated system. Because of the capacity and cost of both large and medium-sized machines, it may be assumed that the auditor will encounter E.D.P. systems only in companies large enough to have a good system of internal control. Although only a relatively few auditors will be required to cope with electronic machines in the near future, the rapidity with which this new type of equipment is being introduced makes the effects of such installations on the field of auditing a matter of concern to the entire profession.

Electronic Data Processing and Internal Control

Internal control could be called the keynote of auditing an E.D.P. installation. It is basically the control of data fed into the system, control of the machine operation and control of the output of the machine. Maintaining the same balance of controls existing in the old system is generally recommended. This is accomplished by requiring that a new control be established to replace each control lost due to the nature of the E.D.P. system. In an attempt to maintain this balance, the following questions have arisen: What are the essentials of a good system of internal control? How have internal controls been affected by E.D.P.? What alternative controls have been established?

The first essential of internal control is a division of duties and responsibili-

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ties among employees or groups of employees in such a manner that no one person has complete accounting control over substantially all phases of a business transaction. However, the opportunities for dividing duties and responsibilities are restricted by the integrated nature of E.D.P., which concentrates much of the responsibility within the equipment and in the hands of the small number of employees controlling the equipment. To offset this weakening of internal control, auditors and management have worked together to formulate alternative controls. It is suggested that the E.D.P. unit be established as a separate responsibility center, independent of the employees originating or authorizing source data, and independent of the employees utilizing or approving the end results. In addition, control can be established over employees operating the equipment by: (1) closely accounting for and reviewing processing time (since human intervention necessary to any manipulation by the operator is very time-consuming), (2) requiring two operators to be present for all processing and (3) rotating operators between shifts, to avoid having the same operators controlling the same processing runs each time.

The second requirement of good internal control consists of procedures formulated to ensure consistent and accurate processing of the source data. The ability of the E.D.P. system to accept data in its original form, without refining, sorting and summarizing, will eliminate the need for many of the normal operating procedures which control the accuracy and completeness of source data under a "manual" system. Therefore, new methods of adding to the reliability of source data have been devised. These include: (1) requiring greater control and check in the operating departments at the time the data is first recorded, (2) making use of any possible independent total to check the E.D.P. total (employee numbers, record counts, etc.) and (3) review of the processed data by personnel at the point of origination.

The third essential of internal control is the existence of procedures to ensure consistent and accurate processing of the data to be processed. This is one area in which E.D.P. adds great strength to internal control because, barring human intervention, E.D.P. equipment can process data with rigid consistency and accuracy far surpassing any equipment previously available. In addition, preventive maintenance, and programmed checks, such as double arithmetic, cross-footing and cross-balancing, add further control.

The fourth requirement of internal control is an intermediate review of documents and records by authorized employees. E.D.P. severely limits such a review because of the meager amount of visible intermediary records necessary in an E.D.P. system. This weakness has been overcome by requiring the machine to "print-out" the proof of a computation or transaction. This "print-

out" is then compared with predetermined totals. In this area, however, there generally has been a willingness to rely on the accuracy of the equipment and the end results. A proof was called for only if the total of individual items did not agree with the end result.

The last essential of good control is a review and interpretation of the end results of the accounting system. This is a second strong point of an E.D.P. system which possesses extensive and flexible ability to produce various analyses and to report end results not formerly available because of equipment limitations.

Electronic Data Processing and Auditing

Fortunately for the auditor, electronic data processing is evolutionary rather than revolutionary. It allows the auditor to gradually adapt old methods and to adopt new methods when necessary. Just as E.D.P. has affected internal control, it has affected auditing. E.D.P. has not altered the objectives of auditing. The basic objectives of an audit are to determine the validity of the source data, to check the accuracy of the processing of the data, and to review the completeness of the data in financial reports. These still remain. However, E.D.P. has changed some of the procedures used to accomplish these objectives.

It is commonly recognized that the greatest possibility of error in electronic data processing lies between the point of origin of the transaction with the source document and the point of input at the processing center. In a highly mechanized operation, the auditor must be especially careful about the areas of human intervention. The auditor should watch for opportunities to simplify the human task and to reduce the possibility of error. This is particularly true where clerks and other unskilled employees are preparing data on which machine decisions will be based. Although the recording of transactions is a danger spot, E.D.P. has not materially affected the auditor's determination of the validity of this source data as such. That is, the problem still remains to relate the source data to the actual existence of assets or liabilities or to the occurrence of transactions.

While the procedures of inspection, observation and confirmation are still very popular, the value of source documents as evidence for the auditor to inspect is undergoing change. In the design and use of source documents, their use as means of accumulating data for processing by the E.D.P. equipment frequently receives greater consideration than their use as evidence of that the transaction occurred. The design of source documents has stressed simplicity, a minimum of manual recording and, frequently, less human review and approval. When filing source documents, there is a tendency to let the documents

remain in the same order in which they were used by the E.D.P. equipment, rather than to sort them into some logical sequence for easier locating. These changes put more reliance on the system of internal control governing the creation of a source document; therefore, the auditor is required to give more attention to the controls as a whole, rather than to the correctness of individual transactions. Another effect of the reduced value of source documents for evidence, coupled with the ability of the E.D.P. equipment to prepare confirmation requests and facilitate comparison of inventory counts, is that it becomes desirable and feasible to make greater use of the extended procedures of direct confirmation of receivables and observation of physical inventories.

The second audit objective of checking the accuracy of the processed and summarized data was one of the areas of most concern when the auditor first encountered E.D.P. Would there be an adequate "audit trail" to permit him to trace end results to the source data? In this connection, it has been stated that electronic data processing may be expected to advance in three stages:

1. Visible source material will be prepared by the same methods as before and converted to machine-sensible information prior to processing.
2. Original source material, both visible and machine-sensible, will be prepared simultaneously. For example, a magnetic tape will be produced as a by-product of a typewriter operation.
3. The source data will be machine-sensible only. For example, no visible card being produced in the use of employees' keys to punch a time clock.

At the present time, most E.D.P. installations which the auditor is likely to encounter will be in Stage 1. As was stated earlier, this is fortunate for the auditor because it will give him an opportunity to amend his procedures gradually and to prepare for the more advanced forms of E.D.P. The desire of management to retain visible records as a precautionary measure has also assisted the auditor. However, in some E.D.P. systems, the conventional audit approach of selecting a number of transactions and tracing them manually through the processing has proven burdensome and difficult. For example, the E.D.P. system may check customer-account balances or inventory-item balances only periodically and, to test this balance control, the auditor must obtain the last prior printed balance and bring it up to date by manually posting all intervening transactions. As a result of this difficulty in applying conventional audit procedures in some systems, as well as the opportunity presented by E.D.P. for developing more effective and efficient audit procedures, auditors have advanced in developing new audit procedures to test the accuracy of processing.

One of the newest approaches is the use of the equipment to test itself and to aid the auditor. In view of the fact that one I.B.M. model 702 can keep up with about 8,500 people operating desk calculators, it is logical to consider the extent to which the equipment itself can be used. The following brief description of three of the many "built-in" controls should convey a general understanding of the basic features of such controls. A fundamental control found in all E.D.P. systems is that of "hash totals." Hash totals are totals of data that would ordinarily not be added into one sum, such as employee numbers, stock numbers, and unit prices. Thus, in a pay-roll computation, it can easily be ascertained whether fictitious employees have been added into the computation, or whether some employees have been omitted. Another common control is that of "reverse multiplication." This is a device used to ensure that an original calculation has been made correctly. Under this method, a calculation of A times B equals C is checked by extending B times A, subtracting C, and determining that the result is zero. "Limit checks" are also used as controls. A limit check is used to see whether certain predetermined limits have been exceeded. Thus, in a calculation of credit sales, it can be determined if Customer X has exceeded his credit limit of say, $20,000 a month.[1]

In addition to such built-in controls, the machine offers many other possibilities of assistance to the auditor. For instance, he may request that the program being used to process data be retained in the machine after the processing is completed. Then he can have the machine process special test data for which he has predetermined the correct end result. Such test data could use items deliberately designed to violate programmed controls, such as weekly pay limits. Or he could include a second or optional routine in the master program, which could be put into use at any time. This special routine could perform a series of checks on both the data being processed and on the data stored in the machine's "memory tape." This technique could also be used to print out more visible copies of transactions than is provided for in the "normal" program. In addition, the machine could be used to interpret machine-sensible data, to check the footings of detailed records, to print out a detailed record of every nth item in a large inventory, and so on. However, in all audit procedures where the machine is used, the auditor must take care to see that the machine operator cannot, without being detected, instruct the machine to disregard totals arrived at in an operation and simply to print the amount desired by him. It may even be necessary for the auditor to assign

[1] "Impact of Electronic Data Processing on Auditing," C. R. Jauchem, *N.A.A. Bulletin*, May, 1958, p. 57.

someone familiar with the machine the responsibility of looking over the shoulder of the operator.

Another new technique available to the auditor to ensure accurate processing is the use of a program control copy. A program control copy is a duplicate of the approved E.D.P. program which is used by the E.D.P. system in processing data. The auditor keeps this copy of the program under his control, and all subsequent changes in the program are submitted to him for inclusion in his copy. One way the auditor can use this control copy is to compare, on an unannounced basis, this copy with the program used during the actual processing of data. In this manner, he can determine whether the approved and attested program is, in fact, being used. As an alternative, the auditor may request that data previously processed with the client's copy of the program be reprocessed with his copy of the program. The end results can then be compared. This method also has the advantage of checking any intervention by the machine operator. There is one disadvantage to the use of control copies that should be mentioned. During the early stage of an E.D.P. installation, a great many program changes are usually required because of events brought to light by actual operation. These changes may make it impractical for the auditor to review them in detail. Therefore, it is advisable not to attempt to formulate a control copy of the program until the system has become reasonably settled.

Still another new audit technique made available to the auditor for use in E.D.P. systems is that of operating controls. An example of an operating control found in industry today is to have a bureau outside the E.D.P. department have control over the operation of the E.D.P. system. This outside bureau controls the E.D.P. system by the predetermination of end results from data made available to it by the originating departments. For example, a company using E.D.P. for pay-roll computation may establish an "outside bureau" for purposes of control of the E.D.P. system. All changes in pay data, such as rate changes, new employees, terminations, and changes in pay deductions, are routed through this bureau. These changes are made by means of an authorization form which is prepared in duplicate in the appropriate department. One of these copies is forwarded to the outside bureau, where the changes are grouped by type of pay data affected, and totals are accumulated by adding machines. The totals of the changes are also computed weekly on a conventional accounting machine and checked to the adding machine totals previously prepared. These totals are then posted to a "spread" sheet. In this way, control is attained. The comparison of these predetermined totals compiled by the bureau is a good technique utilized by the auditor in checking the over-all accuracy of the data processing.

The auditor can also utilize the material obtained as a result of "control by exception." This device is basically the principle of investigating only those transactions that deviate from the ordinary. Therefore, a responsible person would investigate credit given a customer above his credit limit. He would investigate work hours over the normal 40-hour week, and so on. The E.D.P. machine will print out all this "irregular" information, and it becomes a wealth of evidential material to be examined by the auditor.

The third basic objective of an audit is to review the completeness and presentation of the processed data in financial statements. This has also been affected by the popular E.D.P. "control by exception" mentioned previously. Since the E.D.P. machine will automatically print out unusual items, the auditor's job of locating and acting upon these items is easier than when he is required to locate such unusual items by "manual" checking. Because only exceptions from standard are listed, however, the auditor must be aware of every change in standards that is formulated by management, or his review may become significantly different.

Participation During the Conversion Period

A company converting from a conventional accounting system to E.D.P. will normally incur a lapse of about one year between the time the decision is made to convert and the time the system is put into operation. During this period, a high-level committee will be formed to analyze procedures and programs to be used in the computer operations. The degree to which the auditor will participate in these plans depends upon the relationship he maintains with his client. It may be his responsibility to assist the client in the very planning of the system and to review the detailed programs, or his responsibility may be only to protect himself. That is, the auditor's concern may be to determine only how the conversion to E.D.P. will affect internal control and his own audit procedures.

Assuming the latter case is true, the auditor should first study the proposed plan no later than during the "debugging" or trial period. By waiting until this period, the auditor avoids reviewing plans that end up in the wastebasket, but he must make suggestions early enough for them to be effective. Any suggestions made at this time would probably pertain to the amount and effectiveness of internal control evident in the plan. Later on, the auditor will be interested in the period of "parallel" operation, that period during which the E.D.P. system and the system it is to replace are operated together. The auditor should satisfy himself that this period is long enough to subject the E.D.P. system to

every type of transaction it will be expected to handle. He should also make a comparison of the results obtained from the old and the new systems. Another duty of the auditor during the conversion period is to satisfy himself that the master file is accurately prepared, since this is probably the first and only time it will be prepared. The auditor may also assist the client by drawing up hypothetical problems on which the E.D.P. system will be tested and by evaluating the control imposed on the E.D.P. center by outside means, such as the "pay-roll bureau" mentioned earlier.

The question now arises as to how much technical knowledge the auditor should possess to be of real help to his client. This can be answered only generally. The auditor should have sufficient understanding of E.D.P. to intelligently evaluate controls imposed upon the system by outside means and also by internal program controls. However, the adequacy of the checks actually built into the machine by the manufacturer should be left to the technician. The auditor need only satisfy himself that none of these checks has been voided through the use of special techniques.

The Future

The preceding sections of this article have discussed how the auditor has met and dealt with E.D.P. up to the present time. E.D.P. is still in its infancy. It is, therefore, necessary to look at the developments that are likely to take place in the future.

One of the changes that can be expected will be the availability of fewer source documents. In the not too distant future, an employee will not punch a visible time card when entering and leaving the plant but will merely insert a metal identification slug into the time clock which, in turn, will mark a tape that is used directly in the data processing machine. Time worked could be distributed to different jobs by the use of a simple keyboard through which the employee can code the job number and hours worked on a machine tape. These and other operations would each eliminate a visible source document. There are, however, several possibilities of offsetting this loss. Separate written documents might be required for overtime hours or for a major transaction. The machine itself might be programmed to print out all job charges over a budgeted amount, or to report use of certain items. Only experience will prove the degree of effectiveness of such methods.

A second area of concern will be in the continued concentration of data processing in machine centers. Along with this are the related changes necessary in the functional organization. However, these developments need not

weaken internal control or complicate audit procedures if proper supervision, control and procedures are followed with respect to the input data and end results.

The third area of development involves the elimination of detailed records. Some feel that this will not become an acute problem, since the machine is able to print out as much detail as is desired, and also because any information can be held in tape form until it is no longer wanted. Actual experience is contrary to this belief. Because of the efficiency available with electronic machines, it is sometimes impractical to require the machine to produce such records. At times, separate and costly operations must be performed to obtain detailed records. Another reason is the re-usable nature of the magnetic tape.

Since detailed information is valuable to management, as well as to auditors, it seems likely that a mutually agreeable solution can be reached. The one that seems most likely is that of having the machine itself select details of items which are of interest because of their nature, amount, or some other standard. Another result of the elimination of detailed records may be the audit of transactions closer to the time when they are originally processed and recorded on the company's records. This will be due to the desire to make magnetic tapes available for re-use as quickly as possible, and also to refer to items that can be kept available only for a short period.

The future is challenging to the auditor, but if he meets the challenge with increased knowledge and training, he will be able to render more effective and efficient service to his client than was possible before the advent of E.D.P.

Beyond These Covers

Books

Foundations of Accounting for Managerial Control

Lawrence H. Malchman & Albert Slavin, Chilton Company, 56th and Chestnut Streets, Philadelphia 39, Penna., 1961, 811 pp., $8.

The endeavor in this text is to introduce into a first-year accounting course emphasis upon the managerial uses of accounting. Part of this emphasis is in preliminary chapters and part in closing ones on manufacturing operations, cost control and analysis, and financial planning.

Readings in Cost Accounting, Budgeting and Control

William E. Thomas, Jr., Editor, South-western Publishing Company, Cincinnati 27, Ohio, 1960, 833 pp., $7.

A considerable number of *N.A.A. Bulletin* articles are included in the selections made for this book. Topical and subtopical groupings are followed, with the papers also broadly sectionalized into those on "Background and Theory," "Problem Areas of Accounting for Product and Period Costs," "Problem Areas of Planning and Control" and "Reports for Management."

Responsibility Reporting

Kenneth S. Axelson, Editor; Peat, Marwick, Mitchell & Co., 70 Pine St., New York 5, N. Y., Paper Bound, 1961, 185 pp.

Grouped here in several classifications, e.g., "designing a responsibility reporting system," and "performance measurement and profit planning," are reprints from P.M.M. & Co.'s periodical, "Management Controls" and from other publications, including the *N.A.A. Bulletin*. The closing group is made up of case studies. The readings gathered together were first used in an American Management Association seminar.

Mathematics of Accounting

Curtis, Cooper and McCallion, Prentice-Hall, Inc., Englewood Cliffs, New Jersey, Fourth Edition, 1961, 566 pp., $11.

Not primarily a text leading the accountant into unfamiliar mathematics, this book nevertheless includes "commercial algebra." Logarithms, index numbers, graphical presentation and probability are likewise included. All these topics appear in Part II, which follows treatment of "commercial arithmetic" in Part I.

Electronic Data Processing and Auditing

Felix Kaufman, Ronald Press Co., 15 East 26th St., New York 10, N. Y., 1961, 180 pp., $6.

Highly relevant to current thinking, whether related to external or internal auditing or both, this text relates electronic equipment as used to such critical audit matters as "reliability of movement of data" and "audit trail conditions." In connection with the latter, "lookup techniques" of several types are discussed.

1960 Federal Tax Law Changes

Commerce Clearing House, 4025 West Peterson Ave., Chicago 46, Illinois, Paper Bound, 1960, 80 pp., $1.

Devoted mainly to three bills amending the Internal Revenue Code and passed near the end of the 86th Congress, this exposition first presents the significance of principal provisions and then the texts of the acts. Final pages give information on tax bills which were introduced but not enacted.

Comptroller General of the United States (Annual Report)

U. S. Government Printing Office, Washington 25, D. C., Paper Bound, 1961, 321 pp., $1.25.

The work of the U. S. General Accounting Office and its multitude of audit and investigating activities are portrayed in this report, arranged by departments and agencies. Although not accounting for the most part, the activities reported are seldom unrelated to the use of dollars to achieve results.

The Measure of Management

Eliot D. Chapple and Leonard R. Sayles, Macmillan Co., 60 Fifth Ave., New York 11, N. Y., 1961, 218 pp., $6.50.

For accountants this volume will be likely to serve more for background than for specifically usable information. It is subtitled "designing organizations for human effectiveness" and deals broadly with systems, personality, and the management task in a day when change is an insistent consideration.

Non-Profit Corporations and Associations

Howard L. Oleck, Prentice-Hall, Englewood Cliffs, New Jersey, 1959, 460 pp., $12.50.

Bearing as a subtitle, "Organization, Management, and Dissolution," this text is descriptive and explanatory, with the intention of providing "for lawyers and laymen a coherent and logical exposition of procedures, rights and liabilities for non-profit organizations and their members." It does not treat accounting but offers a means of familiarization with forms of non-profit enterprises.

Engineering Data Processing System Design

Arthur D. Even, D. Van Nostrand Co., Inc., Princeton, New Jersey, 1960, 282 pp., $6.50.

A study of needs of engineering departments for better record of activity and results, this new work explores the applicability of various types of data processing equipment to the wide range of function and detail in engineering organization and projects. A glossary of terms from "accounting machine" to "work simplification" occupies 20 pages at the close of the book.

Purchasing Department Organization and Authority

Haas, March and Krech, American Management Association, 1515 Broadway, New York 36, N. Y., Paper Bound, 1960, 119 pp., $4.50.

Identified as A. M. A. Research Study No. 45 and reflecting practices of 147 companies, this presentation contains a chapter which inquires into the relationship of expense for the purchasing function to "direct costs," "all costs" and "size of business." Other chapters explore the "purchasing personnel ratio," the alternatives of centralization and decentralization and the department's authority, relationships and internal procedures.

Physical Distribution Management

Smykay, Bowersox and Mossman, Macmillan Company, 60 Fifth Ave., New York 11, N.Y., 1961, 277 pp., $6.

Intended to clarify factors surrounding decisions which must be made in the area of product distribution, this work is a specific functional study embracing areas (among others) identified as "structure for product flow," "inventory control," "forecasting," "plant location," and "distribution warehousing."

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